I.1
5/1364

REMOVAL ACTION WORK PLAN

FOR

THE FORMER ST. LOUIS SMELTING AND REFINING SITE

COLLINSVILLE, MADISON COUNTY, ILLINOIS

Advanced GeoServices Corp.
1055 Andrew Drive, Suite A
West Chester, Pennsylvania 19380

PROJECT No. 2003-1055-01
MAY 18, 2004

J:\Collinsville Smelter\drawings\2003-1055-01\COVERS

ADVANCED GEOSERVICES CORP. *"Engineering for the Environment"™*

1055 Andrew Drive, Suite A
West Chester, PA 19380-4293
(610) 840-9100 Fax (610) 840-9199
www.agcinfo.com

May 18, 2004 2003-1055-01

Kevin Turner
U.S. Environmental Protection Agency
8588 Rt. 148
Marion, Il 62959

RE: Removal Action Work Plan
St. Louis Smelting and Refining Site
Collinsville, Madison County, Illinois

Dear Mr. Turner;

On behalf of NL Industries, Inc., please find the attached Removal Action Work Plan for the former St. Louis Smelting and Refining Site in Collinsville, Madison County, Illinois.

Advanced GeoServices Corp. is involved in the process of Contractor Selection and hopes to have selected a qualified Contractor to conduct the removal activities in the near future so that we may proceed on a timely schedule.

We look forward to finalizing this Work Plan and will coordinate the final details with USEPA so that we may move forward and begin to implement the work as soon as possible.

Respectfully,
ADVANCED GEOSERVICES CORP.

Christopher Reitman
Project Director

Barbara Forslund
Alternate Project Director

CTR:BLF:kk

cc: Terry Casey, Efficasey Environmental
Marcus Martin, Highland Environmental

ADVANCED GEOSERVICES CORP. *"Engineering for the Environment"™*

1055 Andrew Drive, Suite A
West Chester, PA 19380-4293
(610) 840-9100 Fax (610) 840-9199
www.agcinfo.com

June 18, 2004 2003-1055-01

Mr. Kevin Turner
On-Scene Coordinator
United States Environmental Protection Agency
8588 Rt. 148
Marion, IL 62959

RE: Comments to Removal Action Work Plan
St. Louis Smelting and Refining Site
Collinsville, Illinois

Dear Mr. Turner:

Three copies of revised text and figures to the Removal Action Work Plan for the above referenced project are enclosed. The text and figures have been revised to address USEPA and IEPA comments dated June 7, 2004 and your email of June 16, 2004.

Please replace the text previously submitted with the enclosed pages. The Work Plan text has been submitted for replacement in its entirety. The revised pages are documented with a revision date of June 18, 2004. The sample consent access agreement has been attached in its entirety, and the QAPP's revised pages have been attached individually for insertion. To facilitate your review, responses to comments are provided below.

- **Comment: The work plan does not specifically address soil testing and remediation activities in play areas and gardens. The work plan should include language explaining how a this site specific removal action objective of 600 ppm to 24 inches below ground surface will be achieved in each garden/play area. Also, in accordance with the U.S. EPA guidance, aliquots from play areas and gardens should not be included with other aliquots from the remainder of the residential property.**

  Response: The text has been revised to include obtaining a composite sample in a distinct play area or vegetable garden and to extend the removal depth to 24-inches in these areas if the samples indicate the additional excavation is necessary.

- **Comment: Page 3-2 and Figure 3-1 – The Work Plan establishes two different composite sampling protocols based on the size of the yard (similar in concept to that within U.S. EPA guidance Superfund Lead-Contaminated Residential Sites Handbook, OSWER 9285.7-50). However, U.S. EPA guidance recommends conducting five-point composite sampling within four quadrants of the yard on properties with lot sizes greater than 5,000 ft2. The Work Plan uses .4 acres (17,424 ft2) instead of 5,000 ft2 which results in fewer aliquots per yard and increases the chances of missing a hot spot. Therefore, please change the Work Plan to follow the Lead Handbook on issues related to the size of the sampling layout plans.**

  Response: The Work Plan has been revised to state that yards greater than 5,000 square feet will be sampled in quadrants with five (5) aliquots per exposure area. Yards less than 5,000 square feet will be sampled in two exposure areas except when a large side yard is present. In that instance, the QA official will have the responsibility of determining whether to sample the side yard as an individual exposure area. Figure 3-1 has been renamed 3-1A and revised to reflect the 5,000 square foot adjustment. In addition, a new Figure 3-1B has been created to depict the side yard scenario.

- **Comment: Page 3-3 - The last sentence of this section states that no confirmation sampling will occur at the 15-inch interval. Sampling at 15 inches should be conducted to determine the need for potential marker barriers and/or deed notices. Furthermore, it is reasonable to assume that residents will want to know if soil exceeding removal criteria exists below 15 inches at their property.**

  Response: The text has been revised to include confirmation sampling at the 15-inch depth. We understand USEPA will coordinate any deed notices if necessary.

- **Comment: Pages 3-5 and 3-14 - These paragraphs speak to issues regarding permitting. Removal and Remedial actions conducted on-site under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) do not require permits (i.e. the administrative requirements such as permit applications etc. are not necessary). However, it is NL's responsibility to ensure that all activities conducted at the site comply with the substantive portions of federal, state, and local Applicable or Relevant and Appropriate Requirements (ARARs). A copy of ARARs will be provided at a later date.**

Response: The Respondent acknowledges its responsibility to comply with local, state and federal government ARARS.

- **Comment: Appendix A - The sample access letter states that the AOC is between the U.S. EPA, Illinois EPA and the Respondent. Please correct to remove Illinois EPA from the sample letter.**

  Response: The sample access letter has been revised to state that the AOC is between the USEPA and the Respondent.

- **Comment: Appendix B - Page 9 of 31 - Illinois EPA has found that in some cases, bag thickness can be correlated with a reduction in XRF response. At the beginning of the project, analyses should be run with and without the bag in order to determine (approximately) how the plastic bag will affect XRF readings.**

  Response: Initial samples will be tested in both the XRF testing cylinders and zip-loc baggies to determine concentration result differences, if any, that may occur.

- **Comment: In addition, will the composite samples be analyzed in the field at each individual property or will the samples be brought back to a central location?**

  Response: Text has been added stating that composite samples will be tested at the residence at the time of collection or a central location depending on time and cost-effectiveness.

- **Comment: Page 24, Section 2.10 - Electronic copies of all data should be made available to the agencies upon request.**

  Response: Text has been added stating that electronic copies of all data will be made available to the agencies (USEPA and IEPA) upon request.

- **Comment: Appendix C - Though the U.S. EPA has read the Health and Safety Plan, the agency is neither approving nor disapproving this part of the document. It is the Agency opinion that the health and safety of the on-site workers is the responsibility of NL and their contractors. The Agency expects that each individual adheres to the provisions of 29 CFR 1910.120 while performing their tasks.**

Response: The Respondent and their Contractors understand that they are responsible for Health and Safety on-site of each of its own employees involved in the project.

- **Comment: Appendix H - The schedule indicates that after "winter shut down" the new start up date is 7-25-05. Why start back so late? There is perfectly good weather in April/May/June.**

  Response: The new re-startup date has been revised to April 11, 2004.

Please contact Chris Reitman at (610) 840-9123, Barb Forslund at (610) 840-9145 or Mr. Terry Casey at (281) 351-9441 if you have any questions regarding this submission.

Respectfully,

ADVANCED GEOSERVICES CORP.

Christopher T. Reitman
Project Director

Barbara L. Forslund
Alternate Project Director

CTR/BLF:cf

cc: Terry Casey, Efficasey Environmental
Marcus Martin, Highland Environmental
Kevin O'Rourke, AGC

REMOVAL ACTION WORK PLAN FOR

THE FORMER ST. LOUIS SMELTING AND REFINING SITE

COLLINSVILLE, MADISON COUNTY, ILLINOIS

Prepared By:

ADVANCED GEOSERVICES CORP.
West Chester, Pennsylvania

2003-1055-01
May 18, 2004

TABLE OF CONTENTS

TABLE OF CONTENTS
(Continued)

TABLE OF CONTENTS
(Continued)

LIST OF TABLES

TABLE

LIST OF FIGURES

FIGURE

LIST OF APPENDICES

APPENDIX

1.0 INTRODUCTION

This Removal Action Work Plan (Work Plan) was prepared by Advanced GeoServices Corp. (AGC) on behalf of the Respondent to the Administrative Order on Consent (AOC) Docket # _____ (NL Industries, Inc.) for addressing impacted soil associated with the former St. Louis Smelting and Refining Company (Site) located in Collinsville, Madison County, Illinois. This Work Plan was prepared consistent with discussions between the Respondent, the United States Environmental Protection Agency (USEPA) and the Illinois Environmental Protection Agency (IEPA).

For the purposes of this Work Plan, the Site is defined as the yards associated with the occupied residential properties in the Pine Lake area and on or near the former St. Louis Smelting and Refining Site, where soils exceed 600 ppm average lead concentration, to a maximum depth of 15 inches, due to the operations of the former St. Louis Smelting and Refining Company. The outer boundary of the Site area is shown on Figure 1-1 of the Work Plan. The specific Site area which exceeds the 600 ppm average lead standard to a depth of 15 inches will be defined by delineation sampling in the field, in accordance with this Work Plan.

1.1 PURPOSE OF WORK PLAN

This Work Plan addresses the soil removal and restoration activities to be performed in residential yards in accordance with current USEPA policy and guidance for lead-contaminated residential properties. The objective of the Work Plan is to describe the removal action procedures necessary to remediate yards with average total lead concentrations equal to or greater than 600 milligrams per kilogram (mg/kg or ppm) to a maximum depth not to exceed 15 inches.

1.2 WORK PLAN ORGANIZATION

The remainder of this Work Plan is organized as follows:

- Section 2.0 - Site Background
- Section 3.0 - Removal Action Procedures
- Section 4.0 - Property Owner/Occupant Education Program
- Section 5.0 - Project Organization
- Section 6.0 - Permitting
- Section 7.0 – Reporting
- Section 8.0 - Project Schedule
- Section 9.0 - Health and Safety
- Section 10.0 - References

2.0 SITE BACKGROUND

Historical information and previous site investigations of residential properties are summarized in the Illinois Environmental Protection Agency CERCLA Reassessment report. A summary of the pertinent sections of this information is provided below.

2.1 SITE BACKGROUND HISTORY

The Site includes an estimated 75 to 140 residential properties being addressed as part of the planned removal activities on the north eastern side of Collinsville, in Madison County, Illinois as shown on Figure 2-1 the Site location map. The Site is relatively flat with rolling hills on the northern, southern and eastern portions. The majority of the properties within the Site are residential with sizes ranging from about 0.25 acre to about 1.25 acres.

The St. Louis Smelting and Refining Company reportedly operated a facility in the site vicinity from 1904 to 1933. Primary operations were conducted on approximately 40 acres. Very little information or records of the facility are available. However, it is known that operations of the facility included primary lead smelting. A man-made five-acre (approx.) lake, currently known as Pine Lake, exists on the west side of the Site and a small unnamed lake exists on the eastern side of the Site.

Between 1937 and 1939, portions of the property were sold to Madison County and individual owners. In 1969, the Eagle Picher Company owned 50 acres in the area, including the 40 acres where the facility conducted its primary operations. Residential development in the area around Pine Lake began in the mid 1950's and progressed in phases. Residential development in the Collinwoods Subdivision located to the east of Pine Lake began in the mid 1970's and continued in several phases.

As a result of previous investigations, this Site has been identified to contain lead-impacted soils in the area of Pine Lake.

3.0 REMOVAL ACTION PROCEDURES

3.1 OVERVIEW OF REMOVAL ACTION APPROACH

This section describes the procedures to be implemented during the removal action on the residential yards within the site boundary shown on Figure 1-1. As part of the systematic remediation approach being followed on the removal action yards, the following general steps will be followed for each yard being remediated:

- Obtain property owner consent and property access;
- Sample to determine if remediation is required;
- Conduct a landscape audit (if vegetative removal is necessary);
- Complete property grade control and property boundary delineation (if property lines are in question);
- Conduct photodocumentation of pre-excavation conditions (performed by Contractor);
- Conduct excavation activities;
- Conduct soil confirmation sampling to verify that the performance standard has been met and/or when the maximum depth of excavation (15 inches) has been achieved, whichever occurs first;
- Placement of marker barrier in excavations where soils remain above the performance standard, if necessary; and
- Backfill and perform or provide for restoration of the yard.

Details of the procedures associated with these activities are described below.

3.2 SITE PREPARATION ACTIVITIES

3.2.1 Property Owner Identification and Access

Each property owner was identified through the use of tax maps obtained from Madison County Chief County Assessment Office in 2003. Additional information has been obtained in 2004 to update the information. This information will be used as a starting point for correspondence with the property owner. Prior to any sampling, auditing, intrusive preparation or removal activities, the Respondent will obtain property access from each of the property owners. The access agreement will describe the anticipated activities to be performed on the property. An example of a typical access agreement is provided in Appendix A.

"Best Efforts" will be made to gain access to the property. These best efforts will consist of 1) a regular mail letter request for access 2) telephone calls, 3) a door to door visit, and 4) a title search if needed to identify the property owner. In a case where a property owner denies access or AGC has exhausted the above efforts, AGC will cease efforts to gain access and provide USEPA with a summary in writing of the "Best Efforts".

3.2.2 Composite Sampling

3.2.2.1 **Composite Sampling Procedures**

Composite sampling will be conducted on yards, or yard Exposure Areas (EAs), within the removal action area. An EA is a portion of a yard in which a person would frequent on a daily or weekly basis and therefore become exposed to possible contact with lead impacted soil. In order to simplify the delineation sampling and to avoid patchwork removal areas on individual yards, the yards will be separated into two categories based on lot sizes: less than 5,000 square feet (sf) and greater than 5,000 sf. For yards greater than 5,000 sf, the yard will be divided into four separate EAs (quadrants). For yards less than 5,000 sf, the yard will be divided into two separate EAs (front yard and back

yard). Figure 3-1A illustrates the sampling layout and procedures for these two categories. For yards that have a large side yards, a third composite will be collected. Figure 3-1B illustrates this sampling layout. Delineation sampling will conducted within the Site Boundary (see Figure 1-1) and proceed outward until two properties or 200 feet outside the Site Boundary has been found to be below the 600 ppm composite performance standard. The sampling procedures are described below.

Two composites will be collected per each EA. One composite will be collected for the A horizon (0-6 inches below ground surface (bgs)). The second composite will be collected for the B horizon (6-15 inches bgs). The locations of the aliquots will be equally spaced to develop a single sample representative of the entire EA. The samples for each EA will then be homogenized and a representative sample will be placed in a re-sealable plastic bag or testing cylinder. An X-Ray Fluorescence Analyzer (XRF) will then be used to determine the total lead concentrations for each composite. In addition to the two composites sampled per EA, each designated play area or vegetable garden will be sampled. A composite sample will be collected in each area which will consist of five individual aliquots that are combined, homogenized and tested using the XRF.

Approximately 5% of the samples will be sent off-site to confirm the accuracy of the XRF sampling. The QAPP presented in Appendix B describes the sampling procedures in detail, including sending split samples to an off-site laboratory to develop a correlation between the XRF and the fixed based laboratory. The XRF corrected concentration will be the basis for all removal decisions.

In the event that a six-inch excavation is warranted based on composite sampling, confirmation sampling will be utilized as described in Section 3.3.7 to determine if the yard is successfully remediated and ready for restoration following the 6-inch removal. The Contractor will perform the confirmation sampling and will follow the guidelines in the QAPP using the same sampling and compositing methodology described above. Confirmation sampling will be performed following each excavation interval and screening process.

In some instances, where the Respondent believes that composite sampling would not be necessary, the Respondent may forego the delineation sampling and begin excavation of the yard to a 15-inch depth. Confirmation sampling will be conducted and the results recorded.

3.2.2.2 **Data Evaluation**

Following the composite sampling and data analysis, the average total lead results of each A and B horizon will be compared to the clean-up level of 600 mg/kg. If either horizon sample is equal to or greater than 600 mg/kg, the yard will be scheduled for removal and the excavation depth will be consistent with the sampling results. If both horizon samples are below 600 mg/kg, the yard will be removed from further study and no further action to the yard will be performed.

Results of investigations will be summarized and presented to USEPA and the property owners.

3.2.3 Landscape Audit

As soil removal activities on some yards may require the removal of trees, shrubs, or similar landscaping vegetation, a landscape professional may be retained to perform a landscape audit of each yard. The audit would consist of an inventory of all trees, shrubs, bushes, groundcover (excluding turf), and similar landscaped plants. The professional will provide a monetary replacement cost including installation for all landscaping items which are to be removed as part of the removal action. Replacement cost will be based on average market cost of a replacement item of nursery-stock age (e.g., a mature tree will have a replacement cost equal to the cost of a non-mature nursery-stock tree of the same species). Once the vegetation replacement cost for each yard is established and reviewed with the yard owner, the removal activities will proceed. Prior to restoration activities, the yard owner, together with the Respondent's on-site representative (here-in-after referred to as the Quality Assurance [QA] official), will determine which vegetation was removed during excavation activities. Once this is determined, the property owner will be issued a check for the agreed amount (i.e., the replacement and installation cost of all landscaping removed).

For example, if a yard has 8 shrubs with a replacement cost of $100 and 4 ornamental trees with a replacement cost of $250, and all of the shrubs and 2 of the trees are removed or damaged during soil removal activities, the property owner will receive a check for $1,300 [(8 shrubs x $100/shrub) + (2 trees x $250/tree)]. The property owner can then retain a landscaper at his/her discretion for replacement of removed vegetation. The Contractor will be responsible for establishing the turf (grass) following removal activities (see Section 3.7.3).

In the event where the property owner prefers the landscaping items be replaced by the Contractor, the Contractor will perform the restoration using the audit or the Contractor may hire a local professional landscaping service to perform the work.

It is anticipated that most landscaped areas will be preserved. This can be accomplished by shallow manual excavations around the root systems to allow survival of the vegetation. In accordance with discussions between USEPA and the Respondent, areas of yards where mature trees are located, may receive little or no excavation for the purposes of preservation. Confirmation sampling will be limited to those areas which receive full excavation depth (6-15 inches or an intermediate depth).

3.2.4 Pre-Excavation Meeting

Prior to the start of removal activities on a given yard, the Respondent's representative, the QA official and/or a representative from the Contractor, will meet with each property owner to describe the soil removal and restoration activities to be performed on the yard, including a tentative schedule.

3.2.5 Photodocumentation

Prior to the start of soil removal work, the Contractor will photodocument the condition of the property. This will consist of a video of the entire yard, including existing topography, sidewalks, driveway and building conditions (exterior) as well as the existing vegetation. Still photographs may also be utilized, in addition to video documentation, for easier reference during restoration. All

photodocumentation should be available to the QA official or other Respondent's representatives for review and copying at anytime.

3.2.6 Contractor Permits, Certificates and Licenses

The Contractor will obtain the required construction-related permits, licenses and/or certificates required by local, state and federal agencies to complete the work. Copies will be provided to the QA official and USEPA upon request and all required permits, licenses, and certificates will be obtained prior to initiation of work and retained at the support zone facilities. The Site is within the incorporated areas of the City of Collinsville and permits will be obtained with the help of the USEPA.

3.2.7 Contractor Mobilization

The Contractor will mobilize equipment, supplies, and support zone facilities to the Site as needed to conduct removal activities. Equipment and materials will be inspected for compliance with contract requirements, specifications, material quality and operability by the QA official. Mobilization will occur following the Notice To Proceed and the submission of any required pre-construction submittals. Electric and water service will be supplied by the Contractor as needed in accordance with local, state, and federal regulations to conduct removal operations.

Location of support zone facilities will be identified to the Contractor by the Respondent. The support zone area will be a stable and sufficient surface for office/equipment trailer placement. Operation of temporary sanitary facilities and disposal of sanitary wastes will be conducted by the Contractor in accordance with state and local regulations. Support zone facilities utilized by the Contractor will be removed at project completion.

3.2.8 Decontamination Facilities

The Contractor will establish decontamination facilities and/or stations for personnel and equipment sufficient to support site activities. Decontamination of personnel, equipment, and materials will be performed in accordance with applicable USEPA and OSHA regulations. Additional detail for decontamination facilities and procedures are provided in the Health and Safety Plan (HASP Appendix C).

3.2.9 Soil Staging Area

The Contractor will use a soil staging area in the vicinity of the project Site. It is anticipated that the staging area and the support zone facilities will be located in the same area. The purpose of the staging area is to allow the Contractor to store soil until such time as the disposal facility can accommodate delivery. The staging area may also contain structural fill and topsoil stockpiles. The materials will be covered by the Contractor with 6-mil (min.) polyethylene sheeting when requested by the QA official to eliminate rainwater contact and to provide dust control. Temporary covers will be anchored with sandbags or similar methods to prevent uplift. Also, if treatment of excavated soils is required to meet TCLP standards, an area may be constructed in the staging area to facilitate treatment before sending soils to an off-site disposal facility. The staging area will include controlled access to deter unauthorized personnel from entering the area. The controlled access will be provided by constructing a permanent, 6-foot, chain link, fence with double gates for access. Measures will also be taken to prevent cross contamination and release of fugitive dust emissions. Control measures will include, but not be limited to:

- Barriers between excavated soil, in-situ and backfill soils;
- Construction and safety fencing;
- Earthen berms as stormwater protection;
- Covers of all stockpiles; and
- Dust suppression and air monitoring (see HASP for specifics).

The location of the soil staging area will be approved by USEPA and AGC prior to commencement of staging operations.

3.2.10 Site Security and Safety

Site safety and security will be conducted in accordance with the HASP and the Site Security Plan (Appendices C and D, respectively).

Contamination Reduction Zones (CRZs) and exclusion zones will be identified and demarcated by the Contractor using fencing or high-visibility tape. It is anticipated that these zones will vary based on the active remediation zones.

3.2.11 Grading Control and Documentation

Property pins and boundaries will be located as necessary by the Contractor in the case of a property line dispute or if the Contractor requires to mark the delineation line between removal and non-removal yards. These boundaries will be maintained throughout the duration of work in these areas. The Contractor will determine pre-existing grades of each yard as necessary to verify features and document removal depths. The documentation will include topographical features such as changes in grade and any stormwater features (e.g., swales). This documentation will include spot elevations for soil removal depth control and for restoration of the yard. Following completion of soil removal, the Contractor will document final removal depths. The spot elevations will be at the same location as the topographical pre-excavation points to document that the work performed meets the Work Plan requirements. The information will be shown on the sketches developed by the Contractor. Sketches of each property addressed should be provided by the Contractor two weeks following completion of removal activities.

3.3 SOIL REMOVAL ACTIVITIES

3.3.1 Air Monitoring and Dust Suppression

Air monitoring and dust suppression will be conducted in accordance with the Air Monitoring Plan (included in HASP) and the Fugitive Dust Control Plan (Appendices C and E, respectively).

3.3.2 Erosion and Sedimentation Controls

Erosion, sedimentation, and stormwater control will be performed in accordance with the Stormwater Runoff Control Plan in Appendix F.

3.3.3 Utility Verification

Prior to excavation, the Contractor will coordinate with local utilities and private utility locator services (as necessary) to identify and mark all utilities (underground, surface and above-ground) in accordance with local, state and federal regulations. All utilities will be marked and preserved throughout excavation and restoration. The Contractor will also request utility clearances from local utility companies, as needed. Care will be taken to protect all utilities during operations. Any damaged utilities will be repaired by the Contractor at no cost to the property owner, or the Respondent.

3.3.4 Traffic Control

All excavated and backfill material will be transported via surface streets directly to the staging area or the off-site disposal facility. Proposed traffic routes will be determined by the selected Contractor based on sequencing of removal methods and yards to be remediated. It is anticipated that the routes will use residential streets from the excavation areas to the staging area or the disposal facility. Approval of this Work Plan will constitute that USEPA and IEPA will obtain the unlimited use of

these streets for the duration of the project. The Contractor will control vehicular traffic to make sure activities are performed safely and efficiently and the Contractor and his personnel will remain cognizant of the highly intrusive nature of this work within residential neighborhoods. Speed limits will be established and enforced to minimize dust generation and maintain a safe environment for workers and local residents, including children. All trucks hauling excavated or backfill soil will be tarped during transportation.

3.3.5 Vegetation Removal

Vegetation removal methods will be proposed by the Contractor and approved by the QA official. It is anticipated that vegetation removal will be limited to landscaped items to be removed and replaced as well as miscellaneous standing brush. Soil attached to the roots of removed vegetation will be shaken off at the location of removal. Removed vegetation (excluding grass) will be stockpiled separate from excavated soil materials and will be disposed of at an approved facility or removed vegetation may also be chipped on-site and reused in the restoration process depending on regulatory acceptability. Trees with a bole diameter of three inches or greater at chest height will be protected during remedial activities by hand-digging around the roots and minimizing the depth of soil removal within the footprint of the tree canopy.

3.3.6 Excavation

The removal areas will be excavated by the Contractor to a depth of no more then 15 inches, except in limited areas where trees are located. (See Section 3.3.5) These areas may receive little or no excavation within the critical root zone in order to preserve their integrity. Excavations will be conducted using traditional construction equipment proposed by the Contractor and approved by the QA official. Hand excavations or pressure washing will be conducted in close proximity to structures, utilities, mature trees or other areas that would be difficult to excavate with or that may become damaged by heavy equipment. Soil removal will not be performed beneath structures, roads, sidewalks, brick patios, driveways or other inaccessible or permanent features. Consistent with

USEPA policy, excavation areas will not exceed at any one time one acre per property, with the excavation area centered around the area of maximum exposure on the yard. Most yards identified are less than one acre.

In some instances where easily identified localized materials which exceed 600 mg/kg are identified, localized excavations may be performed to a maximum depth of 15 inches. This will be done to reduce disturbance of entire yards, where practicable.

In the event that a vegetable garden or play area is located within an EA scheduled for removal, the area will be excavated to a maximum depth of 24 inches, provided it is not adjacent to a structural foundation or within a critical root zone of an existing tree which may be detrimental to the survivability of the tree.

Materials will be loaded into transport vehicles for transportation to a temporary stockpile within the Staging Area or direct to the disposal facility.

Under decks or other areas inaccessible by machine equipment, no removal is planned. The QA official may direct the Contractor to place one foot of fill over the existing soils, if areas beneath decks are accessible. Excavation will be performed under structures where it is accessible by machine excavation equipment. The QA official may also direct the Contractor to provide such means as to make these areas inaccessible to children.

3.3.7 Confirmation Sampling

Following a six (6) inch excavation on an EA, confirmation sampling will be performed. Sampling will be conducted by the Contractor and will consist of composite sampling similar to the procedures of delineation sampling (See Section 3.2.2.1). Five discrete soil samples will be collected per each EA. The samples will be collected 0-6 inches in depth. The samples will then be homogenized and a representative sample will obtained and placed in a re-sealable plastic bag or testing cylinder. The

XRF will then be used to determine the total lead concentration of the sample and the corresponding EA. If the result of that testing shows the concentration to be less than 600 mg/kg, then the EA will be considered below the clean-up criteria and backfill can be initiated. If post excavation sampling exceeds 600 ppm average lead concentration, soil will be removed to an intermediate depth and additional sampling will be conducted using the same procedures. No sampling will be performed following a 15 inch excavation. In some instances where it is warranted, the QA official may direct the Contractor to excavate directly to 15 inches in depth instead of the intermediate depth. The correction factor obtained from the 5% off-site laboratory analysis of the composite delineation sampling will be applied to all XRF results and concentrations of the confirmation samples. Final removal depths will be based on the XRF results obtained in the field. If localized pockets of high concentration materials are identified in yards, the localized pockets may be excavated and a representative sample of the excavated area will be used in the final composite used to characterize the exposure area.

3.3.8 Placement of Visible Marker Barrier

Following the excavation to a 15-inch depth and confirmation sampling demonstrates that an EA is above the 600 ppm performance standard, a visible marker barrier will be installed to identify the presence of possible impacted soil below the marker barrier. The barrier shall be visible and not prone to frost heave. Barriers that will be used are orange construction fence, snow fence or a geofabric. Alternate barriers may be placed at the approval of the QA Official and USEPA.

3.3.9 Protection of Existing Property

Throughout site preparation, removal, and restoration activities, the Contractor will implement procedures to protect existing property features from damage. Procedures will include safe working distances, warning tape, manual digging and temporary fencing and barriers. At the completion of work, and as necessary during the course of work in accordance with the applicable plans, driveways

and sidewalks will be cleared using a dry method (e.g., brooms or air sweeping). If a wet method is necessary (e.g., power spray), the Contractor will ensure that the water is collected in a manner such that sediment is prevented from entering stormwater inlets or other structures. Any damage to public or private properties shall be addressed by the Contractor at no expense to the property owner or any other party.

3.4 TREATMENT, TRANSPORTATION AND DISPOSAL

3.4.1 Stockpile Characterization Sampling

Once the excavated material, if it has not been direct loaded to the disposal facility, has been taken to the soil staging area, it will be placed in stockpiles for characterization purposes. It is anticipated that the stockpiles will be approximately 1,000 cubic yards (cy) in volume and that one composite sample will be collected from each stockpile. The composite samples will consist of aliquots collected from at least five randomly-located surface locations from each stockpile. Each aliquot will be collected using trowels, hand augers, and/or shovels. The aliquots will be placed in a mixing bowl and homogenized to generate one composite sample that represents the entire stockpile. Standard sampling and decontamination procedures, which will be followed in the field, are described in the QAPP found as Appendix B. The waste characterization samples will be sent to an approved off-site laboratory for TCLP lead analysis. If the sample result exceeds 5.0 mg/L lead, the stockpile will be stabilized onsite by the Contractor and retested; this process will be repeated until passing results (i.e., TCLP leachate is less than 5.0 mg/L) are achieved. If the waste characterization result is less than 5.0 mg/L, the material will not require treatment, prior to off-site disposal.

3.4.2 In-Situ Characterization Sampling

In addition to the proposed soil stockpile characterization, in-situ characterization sampling may be performed. In-situ characterization will be utilized if the Contractor prefers to transport the excavated soil directly to the disposal facility. This will consist of determining the need for

treatment from a localized area within an area scheduled for removal. A removal area will consist of one or more yards based on proximity of the yards being remediated and will be approximately 1,000 cy in volume based on initial delineation sampling. The composite samples will consist of grab samples (aliquots) collected from at least 5 randomly-located areas about each removal area. Each aliquot will be collected from the ground surface to the excavation depth (determined from initial delineation sampling) using trowels, hand augers, and/or shovels. The aliquots will be placed in a mixing bowl and homogenized to generate one composite sample that represents the entire removal area. Standard sampling and decontamination procedures, which will be followed in the field, are described in the QAPP in Appendix B. The waste characterization samples will be sent to an approved off-site laboratory for analysis of TCLP lead. If the sample result exceeds 5.0 mg/L lead, the excavated soil will be placed in the soil staging area and the stockpile characterization sampling will be implemented. If the sample result is less than or equal to 5.0 mg/L lead, the material will not require treatment and could then be loaded onto trucks for direct transport to the disposal facility.

3.4.3 Soil Stabilization/Treatment

In the event that soil stabilization/treatment is warranted, the soil stockpile will be stabilized in the soil staging area. The stabilization process will be accomplished by mechanical means (e.g., pug mill, trackhoe mixing within a contained area). The stabilization reagent and mixture ratios will be determined by the Contractor based on several effective proprietary and non-proprietary reagents and processes available on the market. Following stabilization of the stockpile, sample will be collected following the procedures in section 3.4.1 and sent to the approved laboratory

It is understood that this work plan will effectively act as the permit for USEPA and IEPA to approve any necessary stabilization treatment of soils required on-site or nearby. Any additional stabilization treatment requirements, if necessary or applicable, should be identified by USEPA or IEPA prior to work plan finalization.

3.4.4 Transportation and Disposal

Following testing (and treatment as necessary) to confirm that the material is non-hazardous (i.e., less than 5.0 mg/L TCLP lead), the material will be loaded into trucks for transportation to one or more pre-approved off-site disposal facilities. Air monitoring and dust control will be conducted in accordance with the HASP and Fugitive Dust Control Plans (Appendices C and E, respectively). Once loaded, the trucks will be tarped and the material transported to the disposal facility. Appropriate local, state, and federal regulations will be followed for documentation, placarding, and transporting of the material. All material will be tracked in accordance with federal, state, and local regulations (e.g. bills of lading or manifests, as appropriate). A summary tracking spreadsheet will be generated at the start of the project and will be updated as soil is exported. At a minimum, the spreadsheet will contain the date and time of shipment, trucking company, truck number, and soil tonnage weighed by a certified scale.

3.5 DEBRIS/TEMPORARY STRUCTURES

During the excavation activities, any debris encountered will be segregated and stockpiled separately. This debris may consist of vegetation, wood, concrete, or brick found below the soil surface. This debris will be disposed of separately from the excavated soil, if requested by the disposal facility. Debris located above the ground surface prior to soil removal operations will be the responsibility of the property owner; however, the Contractor may relocate these items to conduct the soil removal operations. For example, if a trailer is located where excavation is to be performed, the Contractor will move the trailer until topsoil and seeding have been completed and then return it to its original position.

Temporary structures (e.g., above ground pools, sheds) will not be moved for soil removal purposes. Mobile structures (e.g., boat trailers) will be moved to facilitate excavations.

3.6 BACKFILL

The Contractor shall plan on backfilling to pre-excavation grades within 10 calendar days of receipt of confirmatory sample results or following soil removal if the excavation extends to 15 inches. In some cases, the Respondent may elect to extend this period to prevent materials from being placed in areas of standing water or frozen material. Vegetative materials will be removed from within excavation areas prior to backfill. Backfill materials will be temporarily stored in clean areas of the Site or in the soil staging area, as needed. The material will be staged in a manner that minimizes disruption to the adjacent yards. Both structural soil fill and topsoil will be used as backfill as described below.

3.6.1 Structural Soil Fill

Structural soil fill material will be used to achieve backfill grades to within three inches of final grade. Soil samples will be collected prior to use and submitted by the Contractor for laboratory analysis. The analysis will be compared to the Illinois Pollution Control Board (IPCB) soil background concentrations (see Table 3-1) or approved by AGC. Soil fill materials will be free from roots and other organic matter, trash, debris, and stones larger than three inches in any dimension. Soil fill materials will be placed in loose lifts and compacted by mechanical methods as approved by the QA official.

3.6.2 Topsoil Fill

Topsoil material will be a natural, friable soil with organic content of at least 2% and nutrients sufficient to sustain grass growth and free of any trash or other deleterious debris. The maximum particle size will be 3/4 inch and rocks greater than 1/8 inch shall not be greater than 5% total by weight. The Contractor will screen the topsoil so the maximum particle size is not exceeded. Topsoil samples will be collected prior to use and submitted by the Contractor for laboratory analysis and the results will be compared to IPCB soil background concentrations (see Table 3-1) and also

that the topsoil has appropriate soil nutrients and organic content. Topsoil materials will be placed to an approximate 3-inch depth over the structural soil fill material. Once topsoil is placed, it shall be lightly compacted by mechanical methods approved by the QA official and tilled for acceptance of seed, fertilizer, and mulch.

3.7 RESTORATION

3.7.1 Final Grading

All fill replacement areas and areas disturbed by soil removal operations will be uniformly smooth-graded to mimic the pre-excavation grades, except as necessary to permit adequate drainage with the notification and acceptance of the property owner. Grade control will be performed by the Contractor to confirm the appropriate grades and to make modifications as necessary.

3.7.2 Seeding

The Contractor will apply a seed mix tolerant to the local conditions which will expedite initial turf and a more permanent seed mixture for final grass of the restored areas. Straw mulch will be applied upon completion of seeding. The Contractor may opt to use a hydroseed mix which will consist of seed, fertilizer and straw mulch to protect the seed from erosion and predation. Erosion control devices will remain in-place until vegetation has been established in disturbed areas. The Contractor will be responsible for the turf establishment and will prepare a maintenance schedule to allow grass to be established before the onset of inclement weather.

3.7.3 Landscape Restoration

Once the property owner opts for and accepts the issued check for replacement costs of removed vegetation, the property owner will have sole responsibility for landscaping restoration. The Contractor will be responsible for the establishment of grass areas. The Contractor may retain the

services of a local landscape company to assist with turf establishment until its contractual obligations (i.e., mature grass) are met.

The Contractor will also be responsible for returning to the yards to replace eroded topsoil and to reseed any bare areas that did not produce growth as well as remove the erosion and sedimentation control devices. Any turf which does not thrive under local conditions will be replaced or reseeded at the Contractor's sole cost.

4.0 PROPERTY OWNER/OCCUPANT EDUCATION PROGRAM

4.1 COMMUNITY MEETING

Consistent with USEPA policy and guidance on lead-impacted residential sites, the Respondent will assist USEPA with their community relations program (see the Public Relations Plan Appendix G), which will consist of providing assistance to the USEPA at community (public) meetings and individual property owner meetings. Newsletters may also be developed as necessary.

In order to inform the interested public, a community meeting will be conducted at the beginning of the program. The meeting will be lead by USEPA with necessary support from the Respondent. The meeting agenda will be developed by USEPA based on the stage of the project and the information to be presented. At a minimum, the agenda should include the following items:

- Background information of existing conditions;
- Overall project approach;
- Anticipated project schedule; and
- Q & A session.

4.2 PROPERTY OWNER MEETINGS

A meeting with each removal action property owner will be conducted in accordance with Section 3.2.4.

5.0 PROJECT ORGANIZATION

Several organizations, companies and individuals will be involved in the successful performance of the work at the Site. These parties are summarized below and are shown on the organizational chart on Figure 5-1.

5.1 PROJECT COORDINATOR

The Project Coordinator, on behalf of the Respondent, will be Mr. Terry Casey. Mr. Casey will be responsible for overall direction of the removal action including coordinating the efforts of the design, sampling and remediation and apprising the Regulators of project status.

5.2 REGULATORS

The USEPA has designated Mr. Kevin Turner of the Emergency and Enforcement Response Branch, Region 5, as its On-Scene Coordinator (OSC). The OSC shall be responsible for overseeing the Respondent's implementation of the work specified in this Work Plan. The OSC will have the authority vested in an OSC by the National Contingency Plan (NCP), including the authority to halt, conduct, or direct any work that is not being performed consistent with this Work Plan. Absence of the OSC from the Site shall not be cause for stoppage of work unless specifically directed by the OSC.

The Illinois Environmental Protection Agency Project Officer will be Mr. Gerald Willman.

5.3 PROJECT DIRECTOR AND PROJECT MANAGER

AGC will manage and oversee the remedial activities on behalf of the Respondent and will also serve as the Respondent's on-site representative. AGC's Project Director will be either Mr. Christopher Reitman or Ms. Barbara Forslund. Mr. Kevin O'Rourke will function as the Project

Manager and will work closely with the Project Director to provide any necessary support for field activities.

5.4 QUALITY ASSURANCE (QA) OFFICIAL

AGC will provide full-time, on-site, oversight of all soil removal and sampling activities as well as Quality Assurance services. The QA official will be experienced in oversight of soil removal activities and will communicate with the AGC Project Manager.

5.5 REMOVAL CONTRACTOR

The Respondent will retain a contractor to conduct the removal operations. The Contractor will be responsible for completing the removal and restoration work and providing on-site Health and Safety and Quality Control services. The Contractor will be experienced in residential soil excavation, treatment and removal.

5.6 DATA VALIDATION

In conjunction with QA activities, AGC will provide data validation services for all samples collected by AGC which are sent off-site for analysis. The laboratory data will be validated in accordance with USEPA Region 5 Standard Operating Procedure for Validation of CLP Inorganic Data (USEPA, 1993). The QA Manager will be Jennifer Stanhope.

5.7 ANALYTICAL LABORATORY

AGC will utilize STL-Chicago of Chicago, Illinois or another USEPA approved laboratory for analysis of QA soil samples requiring off-site analysis.

6.0 PERMITTING

USEPA approval of this Work Plan constitutes that USEPA and IEPA will ensure that all permitting necessary for the conduct of the work will be expedited and approved in order for the work to be performed according to the proposed schedule and in accordance with this Work Plan. This includes approval of stabilization facilities, if necessary, at or near the Site.

6.1 City of Collinsville

Mike Tognarelli of the Collinsville Streets Department requires a Grading Permit Application to be approved through the City of Collinsville. Kevin Turner, the On-Scene Coordinator of the USEPA, has said that AGC would not need to obtain this permit and USEPA would facilitate all permitting through the IEPA Collinsville office.

6.2 Madison County

AGC has been in contact with Joseph Parente, the Administrator for Planning and Development for Madison County. Mr. Parente stated that because all operations are being conducted within the incorporated areas of the City of Collinsville that there are no permit requirements needed through Madison County.

6.3 Illinois Department of Transportation

The Commercial Vehicle Section of the Division of Traffic Safety was contacted to learn what permitting requirements were necessary. Michelle Fowler of the Division stated that the IDOT has no permit requirements for the project.

6.4 Illinois Department of Environmental Protection

Ms. Tammy Mitchell, a community relations specialist for the IEPA, stated that all required permits would be obtained by USEPA and that it was unnecessary for the Respondent to obtain these permits, however, the Respondent would be required to conduct operations within the requirements of the permits.

6.5 Other Permitting Issues

It is also noted that excavated materials are planned to be disposed of in a permitted Subtitle D facility. Some materials may require on-site treatment prior to disposal.

7.0 REPORTING

7.1 MONTHLY REPORT

AGC, on behalf of the Respondent, will prepare monthly progress reports on the 10th day of every month following the date of receipt of USEPA's approval of the Work Plan through the execution of the AOC. The reports will describe significant developments during the preceding period, including the work performed and any problems encountered, analytical data received during the reporting period, and developments anticipated during the next reporting period, including a schedule of work to be performed, anticipated problems, and planned resolutions of past or anticipated problems.

7.2 FINAL REPORT

Following completion of work items and validation of data, AGC will compile a Final Report for submission to USEPA. The report will include the following information:

- A listing of quantities and types of materials removed off-site or handled on-site;
- A discussion of removal and disposal options considered for those materials, and a listing of the ultimate destination of those materials;
- A presentation of the analytical results of all sampling and analyses performed and accompanying appendices containing all relevant documentation generated during the removal action; and

The report will be submitted within three months following completion of all work and validation of the data.

8.0 PROJECT SCHEDULE

The project schedule will be proposed by the selected Contractor and submitted to the Respondent for review and approval. At this time, AGC has prepared a tentative project schedule (Appendix H) which shows activities beginning on or about 30 days following approval of this Work Plan. This period allows time for the contractor selection and any required up front coordination.

The Contractor is expected to conduct work six days per week to facilitate project completion. Work hours shall be in compliance with local ordinances. As approved by the QA official, extended work hours or weekend work may be necessary to keep on schedule.

9.0 HEALTH AND SAFETY

9.1 HEALTH AND SAFETY PLAN

A HASP has been developed as part or this Work Plan (Appendix C). The remediation Contractor may opt to develop its own HASP for remediation activities. If so, the Contractor's HASP shall meet all the requirements of the current HASP as well as all requirements in the AOC.

10.0 REFERENCES

U.S. Environmental Protection Agency (USEPA). Region 5 Central Regional Laboratory. September 1993. Region 5 Standard Operating Procedure for Validation of CLP Inorganic Data. Chicago, Illinois.

U.S. Environmental Protection Agency (USEPA), Office of Solid Waste and Emergency Response 1996. Soil Screening Guidance: User's Guide. Washington, D.C. 20460 EPA/9355.4-23.

U.S. Environmental Protection Agency (USEPA), Federal Register, 2001. Lead; Identification of Dangerous Levels of Lead; Final Rule. EPA/40 CFR Part 745.

Illinois Environmental Protection Agency (IEPA). 2002. CERCLA Reassessment Report, St. Louis Smelting and Refining, Madison County, Collinsville, Illinois. ILD 980607606 LPC#1194280014

U.S. Environmental Protection Agency (USEPA), Office of Emergency and Remedial Response. August 2003. Superfund Lead - Contaminated Residential Sites Handbook, EPA/9285.7-50

TABLE

TABLE 3-1
CONCENTRATIONS OF CHEMICALS IN BACKGROUND SOILS

Chemical Name	Counties Within Metropolitan Statistical	Counties Outside Metropolitan Statistical Areas (mg/kg)
Aluminum	9,500	9,200
Antimony	4.0	3.3
Arsenic	13.0	11.3
Barium	110`	122
Beryllium	0.59	0.56
Cadmium	0.6	0.50
Calcium	9,300	5,525
Chromium	16.2	13.0
Cobalt	8.9	8.9
Copper	19.6	12.0
Cyanide	0.51	0.50
Iron	15,900	15,000
Lead	36.0	20.9
Magnesium	4,820	2,700
Manganese	636	630
Mercury	0.06	0.05
Nickel	18.0	13.0
Potassium	1,268	1,100
Selenium	0.48	0.37
Silver	0.55	0.50
Sodium	130	130.0
Sulfate	85.5	110
Sulfide	3.1	2.9
Thallium	0.32	0.42
Vanadium	25.2	25.0
Zinc	95.0	60.2
No volatile or semi-volatile organic compounds, herbicides, pesticides, or PCBs above detection limit.		

*BOARD NOTE: Counties within Metropolitan Statistical Areas: Boone, Champaign, Clinton, Cook, DuPage, Grundy, Henry, Jersey, Kane, Kankakee, Kendall, Lake, Macon, Madison, McHenry, McLean, Menard, Monroe, Peoria, Rock Island, Sangamon, St. Clair, Tazewell, Will, Winnebago and Woodford. (Source: Amended at 25 Ill. Reg. 651, effective January 6, 2001, Section 742.TABLE G: Concentrations of Inorganic Chemicals in Background Soils)

FIGURES

Revision	Description	Date	By
1	Addition of Sampled Properties (Historical IEPA Data)	6/18/04	KO

LEGEND:

SITE BOUNDARY

PINE LAKE

NOTES:

1. AREAS FOR DELINEATION SAMPLING ARE BASED ON IEPA SOIL SAMPLING: ADDITIONAL SAMPLING WILL BE PERFORMED TO CONFIRM / ADJUST LINE.
2. INDIVIDUAL PROPERTIES MAY BE CONFIRMED BY ADDITIONAL SOIL SAMPLING BEFORE REMOVAL ACTION IS INITIATED
3. SUBDVISION DRAWING PROVIDED IN NAD 83 ILLINOIS WEST BY MADISON COUNTY MAPS AND PLATS GIS DIVISION
4. SAMPLE LOCATIONS AND TOTAL LEAD CONCENTRATIONS USED TO CREATE FIGURE WERE PROVIDED TO AGC IN ZONE 16 UTM COORDINATE SYSTEM BY IEPA AND CONVERTED TO NAD 83 ILLINOIS WEST COORDINATE SYSTEM.

ST. LOUIS SMELTING AND REFINING SITE

COLLINSVILLE, ILLINOIS

Scale: 1" = 300'	SITE BOUNDARY
Originated By: K.O.	
Drawn By: K.O.	
Checked By: C.T.R.	
Project Mgr: C.T.R.	
Dwg No. 2003-1055-01-18	
Issued: JUN 18 2004	Project No. 2003-105501

Advanced GeoServices Corp.
1055 Andrew Drive Suite A
West Chester, Pennsylvania 19380
(610) 840-9100
FAX: (610) 840-9199

FIGURE: 1-1

Collinsville/drawings/2003-1055-01/2002-1055-01-18

Figure 2

St. Louis Smelting & Refining

May 1926 Sanborn Fire Insurance Map Overlaid on 1999 Aerial Photograph

Pine Lake
Lead Concentrations in Sediment in Parts per million

Legend

Lead Concentrations in Sediment in ppm

- 18.7 - 1868.8
- 1868.8 - 4960
- 4960 - 12998.4
- 12998.4 - 47283.2
- 47283.2 - 86374.4

Location I.D. , Sample Depth

N

40 0 40 80 Meters

Figure 3

Figure 4

Sediment Samples from CERCLA Reassessment
Lead Concentrations at Six Inches in Parts Per Million Analyzed by X-Ray Fluorescence

0 112.5 225 450 675 900 Meters

Legend

Lead Concentrations in parts per million

- 19 - 400
- 401 - 1000
- 1001 - 16000
- 16001 - 47283

N

Figure 5

Pine Lake Surface Water Sampling Locations

Legend

- Surface Water Sampling Location

N

Figure 6

Lead Concentrations in Parts Per Million in Residential Soils
Based on XRF Data and Analytical Data Collected Under State Programs

Figure 7

Residential Soil Sampling Locations
Collected During CERCLA Reassessment and ESI for Analytical Analysis

0 115 230 460 690 920 Meters

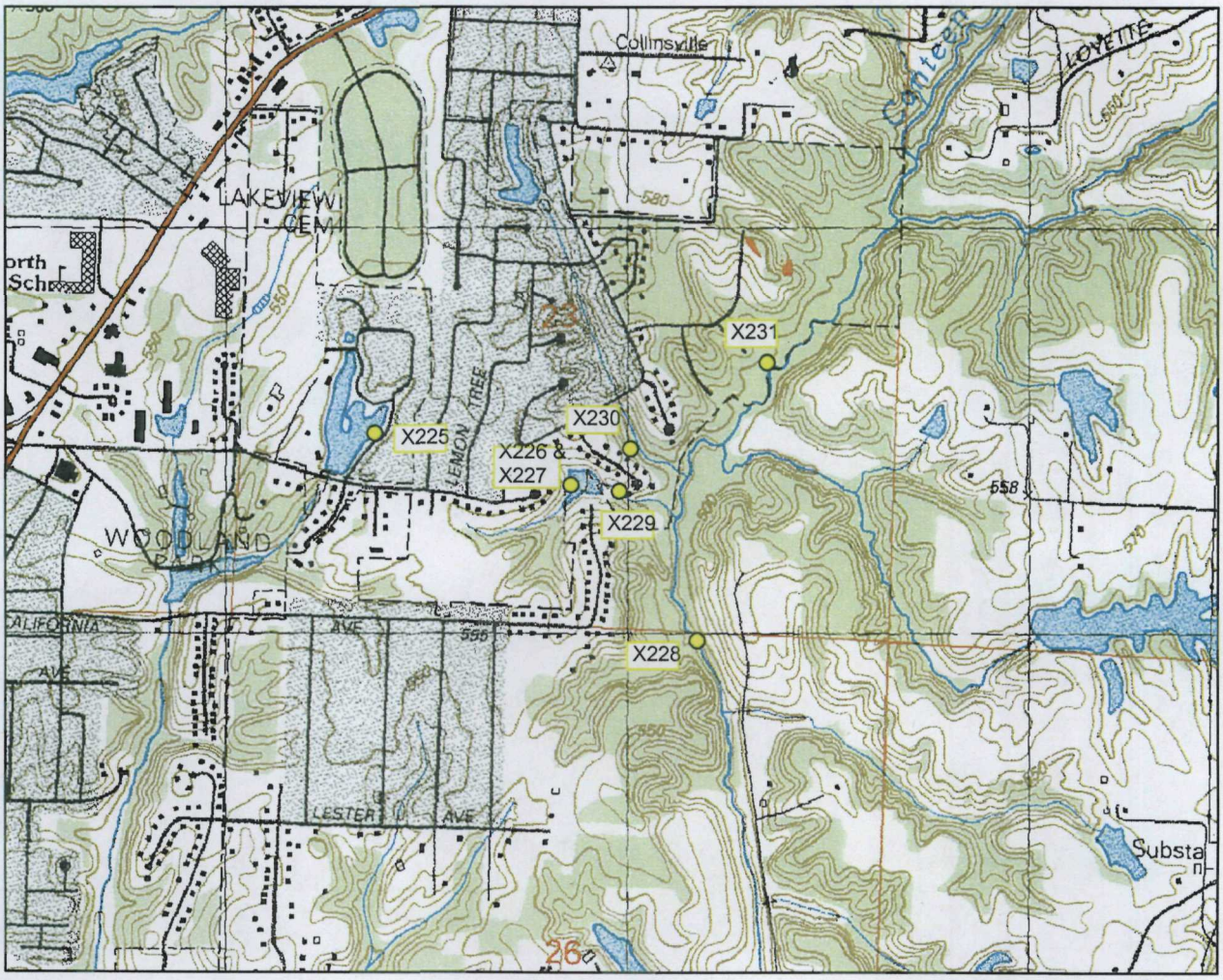
N

Legend

Residential Soil Sampling Location

Figure 8

Expanded Site Inspection
Sediment Sample Locations Collected for Laboratory Analysis



0 300 600 1,200 1,800 2,400 Meters

N

Legend

- Sediment Sample Location

Figure 9

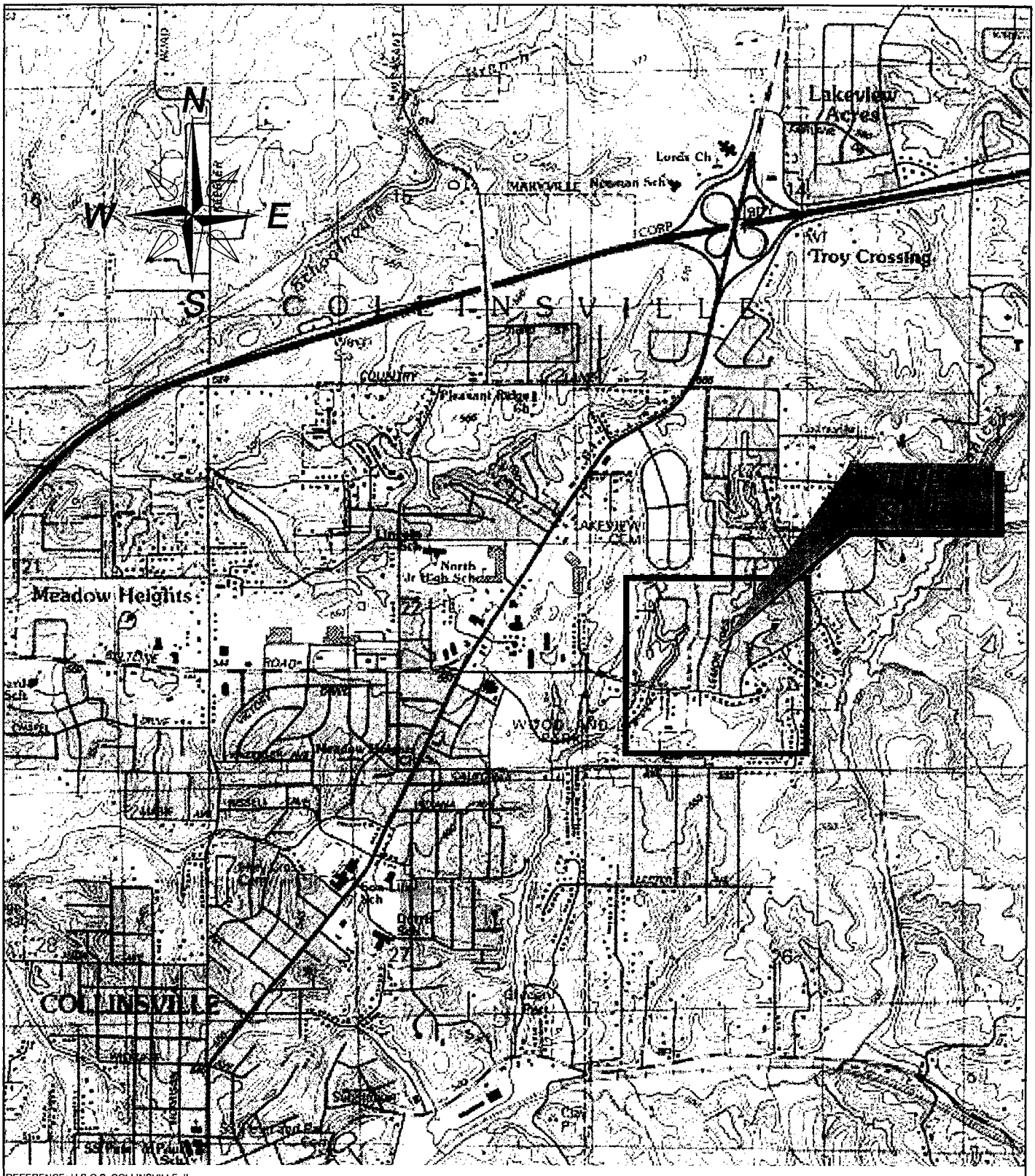
Geoprobe Soil Boring Locations

0 80 160 320 480 640 Meters

Legend

- Geoprobe Soil Boring Location

N



REFERENCE: U.S.G.S. COLLINSVILLE, IL
7.5 MINUTE QUADRANGLE MAP 1991.

ST. LOUIS SMELTING AND REFINING SITE

COLLINSVILLE, ILLINOIS

2000 0 2000 4000

SCALE IN FEET

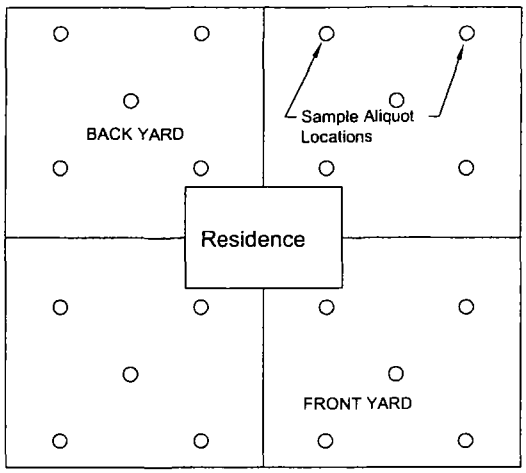
J:\Collinsville Smelter\drawings\2003-1055-01\2003-1055-01-10

Scale: 1" = 2000'	SITE LOCATION MAP
Originated By: K.O.	
Drawn By:	
Checked By:	
Project Mgr: C.T.R.	
Dwg No. 2003-1055-01-10	
Issued: MAY 18 2004	Project No 2003-1055-01

Advanced GeoServices Corp.
1055 Andrew Drive, Suite A
West Chester, Pennsylvania 19380
(610) 840-9100
FAX: (610) 840-9199

FIGURE: 2-1

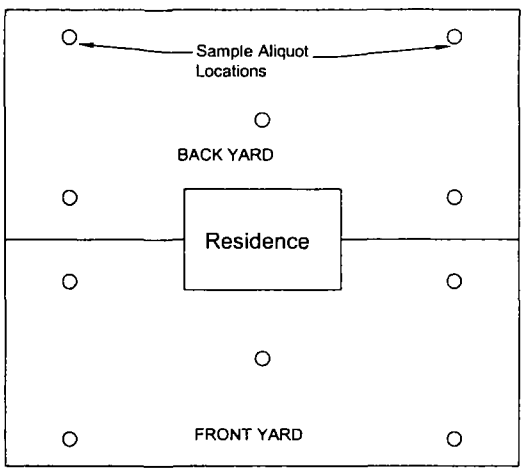
Revision	Description	Date	By
1	AS PER U.S. EPA COMMENTS	6/16/04	KO



PROPERTIES > 5,000 Square Feet
4 COMPOSITES PER PROPERTY FOR EACH HORIZON (DEPTH INTERVAL).

COMPOSITE SAMPLING PROCEDURES

1.) Remove vegetation to access bare soil on all sampling points within each Exposure Area (EA).
2.) If there is a distinct play area or vegetable garden, collect a 5-point composite sample for each, where applicable.
3.) Use stainless steel trowel or hand auger to obtain aliquot from each horizon at sampling point (0-6 inches and 6-15 inches)
4.) Homogenize all aliquots from same depth interval and EA.
5.) Collect representative sample from homogenized aliquots and place in self sealing plastic bag or testing cylinder. Note: sample should have at least a $\frac{3}{8}$ inch depth for testing.
6.) Use X-Ray Flourescence (XRF) to determine average total lead concentration for each EA on the property.
7.) Record testing results and create sketch of property which shows each discrete sampling location so that the points can be located at a future date.



PROPERTIES < 5,000 Square Feet
2 COMPOSITES PER PROPERTY FOR EACH HORIZON (DEPTH INTERVAL).

COMPOSITE SAMPLING PROTOCOLS

1.) Soil samples will be collected at a minimum of 10 feet from painted permanent structures, roads and driveways.
2.) Samples will be collected at a minimum of 5 feet from down-spouts and drainage features.
3.) Samples will be collected at a minimum of 5 feet from potential property specific contamination sources, (i.e., trash burning areas, barebecues, waste storage areas, etc).
4.) Samples will not be collected beneath asphalt, concrete or crushed stone/gravel driveways or parking areas.

Reference
Figure developed from CERCLA Superfund Lead-Contaminated Residential Sites Handbook (EPA, 2003).

ST. LOUIS SMELTING AND REFINING SITE

COLLINSVILLE, ILLINOIS

Scale: NO SCALE	GENERAL COMPOSITE SAMPLING LAYOUT
Originated By: K.O.	
Drawn By:	
Checked By:	
Project Mgr: C.T.R.	
Dwg No. 2003-1055-01-27	
Issued: JUN 18 2004	Project No. 2003-1055-01

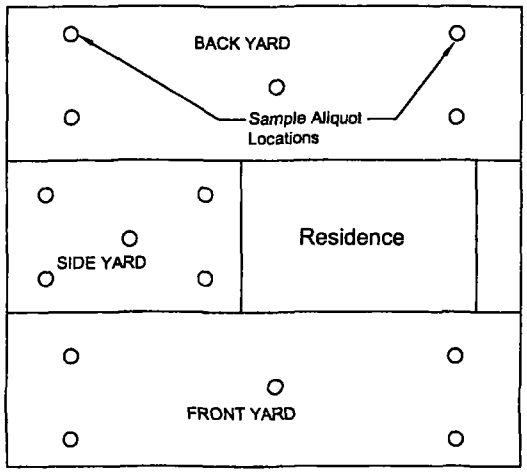
Advanced GeoServices Corp.
Chadds Ford Business Campus, Rts. 202 & 1
Brandywine One, Suite 202
Chadds Ford, Pennsylvania 19317

FIGURE: 3-1A

Collinsville/drawings/2003-1055-01/2002-1055-01-27

COMPOSITE SAMPLING PROCEDURES

1.) Remove vegetation to access bare soil on all sampling points within each Exposure Area (EA).
2.) If there is a distinct play area or vegetable garden, collect a 5-point composite sample for each, where applicable.
3.) Use stainless steel trowel or hand auger to obtain aliquot from each horizon at sampling point (0-6 inches and 6-15 inches)
4.) Homogenize all aliquots from same depth interval and EA.
5.) Collect representative sample from homogenized aliquots and place in self sealing plastic bag or testing cylinder. Note: sample should have at least a $\frac{3}{8}$ inch depth for testing.
6.) Use X-Ray Flourescence (XRF) to determine average total lead concentration for each EA on the property.
7.) Record testing results and create sketch of property which shows each discrete sampling location so that the points can be located at a future date.



PROPERTIES < 5,000 Square Feet with Side Yard
3 COMPOSITES PER PROPERTY FOR EACH HORIZON (DEPTH INTERVAL).

COMPOSITE SAMPLING PROTOCOLS

1.) Soil samples will be collected at a minimum of 10 feet from painted permanent structures, roads and driveways.
2.) Samples will be collected at a minimum of 5 feet from down-spouts and drainage features.
3.) Samples will be collected at a minimum of 5 feet from potential property specific contamination sources, (i.e., trash burning areas, barebecues, waste storage areas, etc).
4.) Samples will not be collected beneath asphalt, concrete or crushed stone/gravel driveways or parking areas.

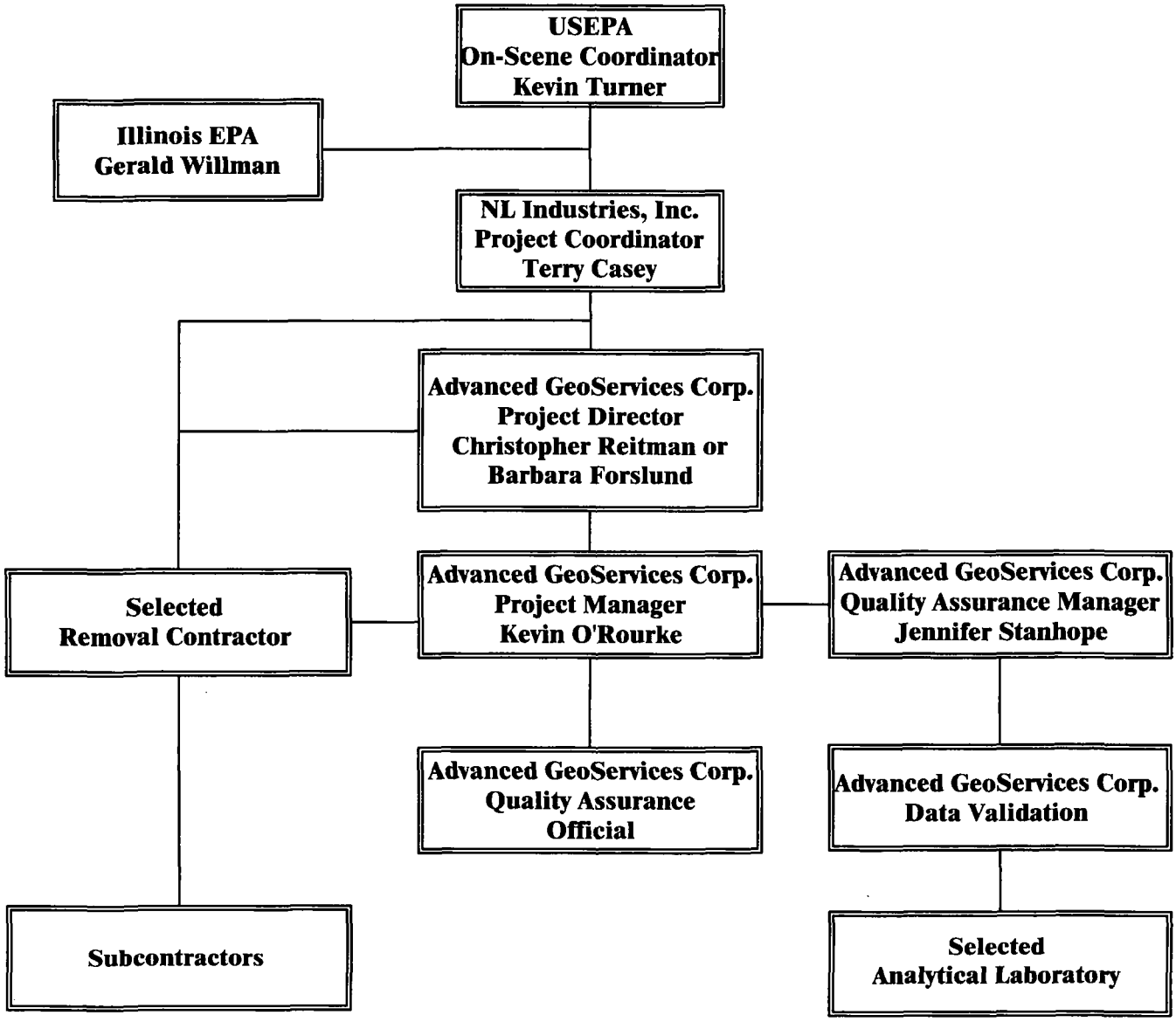
Reference
Figure developed from CERCLA Superfund Lead-Contaminated Residential Sites Handbook (EPA, 2003).

ST. LOUIS SMELTING AND REFINING SITE
COLLINSVILLE, ILLINOIS

Scale: NO SCALE	SIDE YARD COMPOSITE SAMPLING LAYOUT
Originated By: K.O.	
Drawn By:	
Checked By:	
Project Mgr: C.T.R.	
Dwg No. 2003-1055-01-27	
Issued: JUN 18 2004	Project No. 2003-1055-01 — FIGURE: 3-1B

Advanced GeoServices Corp.
Chadds Ford Business Campus, Rts. 202 & 1
Brandywine One, Suite 202
Chadds Ford, Pennsylvania 19317

Collinsville/drawings/2003-1055-01/2002-1055-01-27



ST. LOUIS SMELTING AND REFINING SITE

COLLINSVILLE, ILLINOIS

Scale: NO SCALE	PROJECT ORGANIZATION
Originated By: KO	
Drawn By:	
Checked By: KO	Advanced GeoServices Corp.
Project Mgr: CTR	1055 Andrew Drive, Suite A West Chester, Pennsylvania 19380 (610) 840-9100 FAX: (610) 840-9199
Dwg No. 2003-1055-01-09	Project No 2003-1055-01
Revised: MAY 18 2004	FIGURE: 5-1

J:\Collinsville Smelter\drawings\2003-1055-01\2003-1055-01-09

APPENDIX A

SAMPLE ACCESS AGREEMENT

June ___, 2004 2003-1055

RE: Former St. Louis Smelter
Consent for Access

Dear **[property owner's name]**:

On behalf of the Respondent (NL Industries Inc.), Advanced GeoServices Corp. (AGC) is providing environmental services in the community of Collinsville, Illinois. These services consist of soil sampling and, if necessary, clean up work in your neighborhood. Advanced GeoServices Corp. (AGC) is requesting permission to come onto your property located at **[property address]** to sample soils in your yard and (if necessary) conduct removal activities in your yard. These activities are being performed according to an Administrative Order on Consent between the United States Environmental Protection Agency (EPA and the Respondent.

We are asking your permission for AGC employees, and contractors hired by the Respondent, and USEPA to come onto your property (yard only) to conduct soil sampling, soil removal (if necessary) and replacement of any landscaping that might be disturbed. The soil sampling involves hand-digging several small holes in your yard to collect samples. All of the sampling holes will be filled after the sampling with topsoil and the grass returned or new grass seed planted. The soil removal operations, if necessary, would involve the removal of surface soil to a depth from 6 to 15 inches from your yard, replacement with clean soil, replacement of grass with seed and replacement of any trees, shrubs, bushes, etc., that might be removed to complete the work.

Prior to any soil removal operations, representatives from AGC or the selected remedial Contractor will meet with you to discuss the specifics of the activities including schedule, landscaping, and methods of removal and restoration.

Enclosed you will find a "Property Owner Consent Form" which we ask you to sign and return in the postage paid envelope to grant us permission to perform a survey of your property (if necessary), collect soil samples, and conduct soil removal operations. Again, actual soil removal operations, if necessary, will not be performed until we meet with you to discuss the specifics. Your participation is needed for successful completion of this phase of work. There will be no cost to you, and results of any testing performed on your property will be provided to you by AGC.

If you have any questions, please call myself at (610) 840-9159 or my assistant Kim Keenan (610)-840-9183. The Respondent and AGC thank you for your cooperation.

Very truly yours,

ADVANCED GEOSERVICES CORP.

Kevin O'Rourke
Sr. Staff Professional

KO:kk

Enclosure

PROPERTY OWNER CONSENT FORM

I hereby consent to the entry upon our premises by representatives, or contractors of the Respondent, Advanced GeoServices Corp. (AGC), the United States Environmental Protection Agency, and the Illinois Environmental Protection Agency for the purpose of soil sampling and potential soil removal operations. We understand that pre-removal surveys and sampling may be performed once this form is signed; however, actual soil removal operations, if necessary, will not be performed until AGC or the selected remedial Contractor meet with me to discuss in detail the work that is to be performed. There is no cost to me, the property owner, and all costs associated with the soil sampling, removal, and related operations will be paid by the Respondent.

Owner (Please Print)	Date
Signature	Street Address
Phone Number (required)	City, State, Zip Code

APPENDIX B

QUALITY ASSURANCE PROJECT PLAN

QUALITY ASSURANCE PROJECT PLAN FOR

COLLINSVILLE, ILLINOIS PROPERTIES

Prepared By:

ADVANCED GEOSERVICES CORP.

West Chester, Pennsylvania

2003-1055-01

May 18, 2004

QUALITY ASSURANCE PROJECT PLAN FOR

COLLINSVILLE, ILLINOIS PROPERTIES

Prepared By:

ADVANCED GEOSERVICES CORP.

West Chester, Pennsylvania

Christopher T. Reitman
Project Director

Jennifer M. Stanhope
QA Manager

DISTRIBUTION LIST

Kevin Turner
U.S. Environmental Protection Agency
8588 Rt. 148
Marion, IL 62959

Terry Casey
EffiCasey Environmental LLC
14015 Park Drive Suite 109
Tomball TX 77375

Marcus Martin Esq
Highland Environmental
1630 30th St Suite 600
Boulder CO 80301

TABLE OF CONTENTS

TABLE OF CONTENTS
(Continued)

PAGE NO.

TABLE OF CONTENTS
(Continued)

PAGE NO.

LIST OF TABLES

LIST OF FIGURES

TABLE OF CONTENTS
(Continued)

LIST OF ATTACHMENTS

ATTACHMENTS

1. Resume
2. STL - Chicago Quality Assurance Manual

1.0 PROJECT MANAGEMENT

1.1 PROJECT/TASK ORGANIZATION

This Quality Assurance Project Plan (QAPP) has been developed to present the quality assurance measures that will be used during the Removal Action (RA) activities at the former St. Louis Smelting and Refining Company (Site) located in Collinsville, Madison County, Illinois. The QAPP was prepared by Advanced GeoServices Corp (AGC) on behalf of the Respondent (NL Industries, Inc.) and is Appendix B of the RA Work Plan (Work Plan). This QAPP was written in accordance with the draft Administrative Order on Consent between the Respondent and the United States Environmental Protection Agency (EPA). The QAPP has been prepared based on guidance presented in the "EPA Requirements for Quality Assurance Project Plans" (QA/R-5, EPA/240/B-01/003, March 2001) and the "A Guidance for the Data Quality Objective Process" (QA/G-4, EPA/600/R96/055, March 2001).

While all personnel involved in an investigation and in the generation of data are implicitly a part of the overall project and quality assurance program, certain individuals have specifically delegated responsibilities. For samples collected by AGC personnel and/or their subcontractors, the analysis of the samples will be performed by Severn Trent Laboratories (STL - Chicago) located in Chicago, IL or another EPA approved laboratory. Figure QAPP-1 presents the basic organizational structure for the QA/QC program. The following sections provide additional detail on key QA individuals.

1.1.1 Project Director - Christopher Reitman or Barbara Forslund (AGC)

The Project Director is an experienced manager and technical professional who provides quality assurance (QA) review, assists in the coordination of the Remedial Action, participates in major meetings and regulatory negotiations and provides upper level contact for the client.

1.1.2 QA Official – To Be Determined (AGC)

The QA Official will be responsible for any field sampling tasks and for the day-to-day field activities. The QA Official will also be responsible for field quality assurance and other non-analytical data quality review. Additional responsibilities of the QA Official will include the verification for accuracy of field notebooks, chain-of-custody records, sample labels, and other field-related documentation.

1.1.3 QA Manager - Jennifer M. Stanhope (AGC)

The QA Manager will work on all projects requiring the collection of data, and as such is not directly involved in the routine performance of technical aspects of the investigations. The QA Manager's responsibilities include the development, evaluation, and implementation of the QAPP and procedures appropriate to the investigation. Additional responsibilities include reviewing project plans and revising the plans to ensure proper quality assurance is maintained. The QA Manager is also responsible for all data processing activities, data processing quality control and final analytical data quality review.

It is a major responsibility of the QA Manager to ensure that all personnel have a good understanding of the QAPP, an understanding of their respective roles relative to one another, and an appreciation of the importance of the roles to the overall success of the program. The QA Manager's resume has been included as an attachment to the QAPP (Attachment 1) documenting the requisite experience.

1.2 PROBLEM DEFINITION/BACKGROUND

The Site is located on the southwestern quarter of Section 23, Township 3 North, Range 8 West of the Third Principal Meridian east of Route 159. The Site includes about 40 acres east of Pine Lake. Figure 2-1 in the Work Plan shows the general location of the Site.

St. Louis Smelting and Refining Company owned and operated a primary smelter (facility) in the vicinity of the Site from 1904 to 1933. Primary operations were conducted on approximately 40 acres. Operations consisted of primary lead smelting.

Between 1937 and 1939, portions of the property were sold to Madison County and individual owners. In 1969, the Eagle Picher Company owned 50 acres in the area, including the 40 acres where the facility conducted its primary operations. Residential development in the area began directly north and south of Pine Lake in the 1950's. Residential development to the east of Pine Lake (Collinwoods Subdivision) began in the mid 1970's and progressed in phases.

1.3 PROJECT/TASK DESCRIPTION

The RA portion of the Site consists of approximately 75-140 residential properties as shown on Figure 1-1 in the Work Plan. RA properties have average total lead concentrations equal to or greater than 600 mg/kg.

1.4 QUALITY OBJECTIVES AND CRITERIA

Data will be used to delineate the volume and limits of lead in soils equal to or exceeding 600 mg/kg. To meet this goal, data quality objectives (DQOs) have been established as described below. DQOs are qualitative and quantitative statements specifying the quality of the environmental data required to support the decision making process. Separate DQOs are designed for field sampling and laboratory analysis so that clear distinctions can be isolated with respect to cause between any problems found in the system. Conversely, the DQOs are also designed to provide an indication of the variability of the overall system. The overall QA objective is to keep the total uncertainty within an acceptable range that will not hinder the intended use of the data.

1.4.1 Field Investigation Quality Objectives

The main field investigation DQO is to collect high quality data using the proper collection techniques in a repeatable and consistent manner. The following sections discuss the boundaries and the decision rule for the Site. To reduce the random and systematic errors that are introduced in the measurement process during physical sample collection, sample handling, and sample analysis, field duplicates, equipment blanks, and matrix spike/matrix spike duplicate (MS/MSD) samples will be collected.

- Field duplicates are independent samples collected in such a manner that they are equally representative of the sampling point and parameters of interest at a given point in space and time. Field duplicate samples provide precision information of homogeneity, handling, shipping, storage, preparation and analysis. One field duplicate will be collected for every twenty (20) samples collected for either XRF or laboratory analysis.

- Equipment blanks are designed to address cross-contamination between sample sources in the field due to deficient field equipment decontamination procedures. This blank also addresses field preservation procedures, environmental site interference and the integrity of the source water for field cleaning. One equipment blank will be collected per day when sampling equipment is decontaminated.

- The MS/MSD samples monitor any possible matrix effects specific to samples collected from the Site. In addition, the analysis of MS/MSD samples check precision by comparison of the two spike recoveries. MS/MSD are collected from the same location as the parent sample and are analyzed for the same parameters as the parent sample. One MS/MSD sample will be collected for every twenty (20) samples collected and sent to STL-Chicago for analysis.

The acceptance criteria for the field duplicates and blanks are presented in Table QAPP-1.

1.4.1.1 **Removal Action Properties**

The boundary of the removal action properties will be identified by delineation sampling as described in the Work Plan and based on the Illinois Environmental Protection Agency (IEPA) data available. Removal Action yards will be those whose average soil lead concentration is equal to or greater than 600 mg/kg.

1.4.2 Laboratory Data Quality Objectives

The ultimate objective for STL-Chicago (or any laboratory) is to provide flawless data. However, it is not probable that the analyses will be performed flawlessly and without any need to re-extract or re-analyze samples due to dilution factors, sample matrix, poor surrogate recoveries, analyst error, etc. To reduce the random and systematic errors that are introduced in the measurement process during sample handling, sample preparation, sample analysis, and data reduction, method blanks, MS/MSD and laboratory control samples will be collected. Each are described below:

- Method blanks are generated within the laboratory during the processing of the actual samples. These blanks will be prepared using the same reagents and procedures and at the same time as the project samples are being analyzed. If contamination is found in the method blank, it indicates that similar contamination found in associated samples may have been introduced in the laboratory and may not have actually been present in the samples themselves. Guidelines for accepting or rejecting data based on the level of contamination found in the method blank are presented in the specified analytical method. A minimum of one method blank per 20 samples will

be analyzed or, in the event that an analytical round consists of less than 20 samples, one method blank sample will be analyzed per round.

- MS/MSD samples determine accuracy by the recovery rates of the compounds added by the laboratory (the MS compounds are defined in the analytical methods). The MS/MSD samples also monitor any possible matrix effects specific to samples collected from the Site and the extraction/digestion efficiency. In addition, the analysis of MS and MSD samples check precision by comparison of the two spike recoveries. One MS and MSD sample will be collected for every 20 samples collected per matrix and sent to STL-Chicago for analysis.

- The Laboratory Control Sample (LCS) is prepared by the laboratory by adding analytes of known concentrations to solution (DI water for metals analysis) for analyses. The LCS is prepared, analyzed and reported once per sample delivery group (SDG). The LCS must be prepared and analyzed concurrently with the samples in the SDG using the same instrumentation as the samples in the SDG. The LCS is designed to access (on a SDG-by-SDG basis) the capability of the laboratory to perform the analytical methods. If the analytes present in the LCS are not recovered within the criteria defined in the specified analytical methods, the samples will be re-analyzed or data will be flagged by the laboratory.

The acceptance criteria for the laboratory QC checks are presented in Table QAPP-1.

1.4.3 Criteria Objectives

RA Properties are defined as containing average soil lead concentrations of 600 mg/kg or greater. The laboratory must be able to meet this limit. Table QAPP-2 contains the laboratory reporting limits (RLs) for inorganics to show that the analytical methods selected are below or meet the criteria

objective. STL-Chicago will be expected to report the RLs for all samples in the appropriate statistical reporting units for all analytes. However, it should be noted that actual RLs are sample specific and depend on variables such as dilution factors, sample matrices, percent moisture, and the specific analyte.

1.4.4 Data Management Objectives

It is a data management objective that all aspects of the investigation from sample design, collection, shipment, analysis use/decisions, etc. be performed in conjunction with rigorous QA/QC documentation. The specific details of this documentation can be found throughout this document. It is expected that by the design of separate data quality requirements for field sampling and laboratory analysis, clear distinctions can be made such that any problems found in the system can be isolated with respect to the cause. Conversely, the data quality requirements are also designed to provide an indication of the variability inherent to the overall system.

The overall data management objective is to provide a complete data base with a high degree of confidence through the use of a phased approach of sampling, analysis, data assessment (data review), data qualification, and feedback.

1.5 SPECIAL TRAINING/CERTIFICATION

Field sampling will be performed by one or more technicians. The QA Official will be matched to the project based on the field sampling being performed and the sampling-specific experience level of the technician.

The training and/or certification for the laboratory personnel is presented in the STL Quality Assurance Manual (QAM).

Data validation will be performed by a trained QA Scientist and reviewed by the QA Manager. The QA Scientist will have experience validating inorganic data packages.

1.6 DOCUMENTS AND RECORDS

The documentation of sample collection will include the use of bound field logbooks in which all information on sample collection and field instrument calibration will be entered in indelible ink. Appropriate information will be entered to reconstruct the sampling event, including site name (top of each page), sample identification, brief description of sample, date and time of collection, sampling methodology, field measurements and observations, and sampler's initials (bottom of each page with date).

The following documents will be collected as necessary and filed; as part of the QA process

- logbooks;
- field data records;
- correspondence;
- chain-of-custody records;
- analytical reports;
- data packages;
- photographs;
- computer disks; and
- reports.

2.0 DATA GENERATION AND AQUISITION

2.1 SAMPLING PROCESS DESIGN

During Site remediation activities, soil sampling will be conducted to confirm work activities and to characterize the soil for disposal purposes. Sampling and delineation sampling will occur. Each type of sampling is described below.

2.1.1 Removal Action Properties Sampling

2.1.1.1 **Composite Sampling Procedures**

Composite sampling will be conducted on yards, or yard Exposure Areas (EAs), within the removal action area. An EA is a portion of a yard in which a person would frequent on a daily or weekly basis and therefore become exposed to possible contact with lead impacted soil. In order to simplify the delineation sampling and to avoid patchwork removal areas on individual yards, the yards will be separated into two categories based on lot sizes: less than 5,000 square feet (sf) and greater than 5,000 sf. For yards greater than 5,000 sf, the yard will be divided into four separate EAs (quadrants). For yards less than 5,000 sf, the yard will be divided into two separate EAs (front yard and back yard). Figures 3-1A and 3-1B illustrate the sampling layout and procedures for these two categories. Delineation sampling will conducted within the Site Boundary (see Figure 1-1) and proceed outward until two properties or 200 feet outside the Site Boundary has been found to be below the 600 ppm composite performance standard. The sampling procedures are described below.

Two composites will be collected per each EA. One composite will be collected for the A horizon (0-6 inches below ground surface (bgs)). The second composite will be collected for the B horizon (6-15 inches bgs). The locations of the aliquots will be equally spaced to develop a single sample

representative of the entire EA. The samples for each EA will then be homogenized and a representative sample will be placed in a re-sealable plastic bag or testing cylinder. An X-Ray Fluorescence Analyzer (XRF) will then be used to determine the total lead concentrations for each composite. In addition to the two composites sampled per EA, each designated play area or vegetable garden will be sampled. A composite sample will be collected in each area which will consist of five individual aliquots that are combined, homogenized and tested using the XRF.

At the beginning of the project, analyses will be run with and without the plastic bag in order to determine (approximately) how the plastic bag used will affect (if any) the XRF readings.

2.1.12 **Confirmation**

Following a six (6) inch excavation on an EA, confirmation sampling will be performed. Sampling will be conducted by the Contractor and will consist of composite sampling similar to the procedures of delineation sampling (See Section 3.2.2.1). Five discrete soil samples will be collected per each EA. The samples will be collected 0-6 inches in depth. The samples will then be homogenized and a representative sample will obtained and placed in a re-sealable plastic bag or testing cylinder. The XRF will then be used to determine the total lead concentration of the sample and the corresponding EA. If the result of that testing shows the concentration to be less than 600 mg/kg, then the EA will be considered below the clean-up criteria and backfill can be initiated. If post excavation sampling exceeds 600 ppm average lead concentration, soil will be removed to an intermediate depth and additional sampling will be conducted using the same procedures. The correction factor obtained from the 5% off-site laboratory analysis of the composite delineation sampling will be applied to all XRF results and concentrations of the confirmation samples. Final removal depths will be hard on the XRF results obtained in the field. If localized pockets of high concentration materials are identified in yards, the localized pockets may be excavated and a representative sample of the excavated area will be used in the final composite used to characterize the exposure area.

2.1.1.3 **Stockpile Characterization Sampling**

Stockpile characterization sampling will be performed in the soil staging area, soil will be placed in stockpiles for characterization purposes. It is anticipated that the stockpiles will be approximately 1,000 cy in volume. Soil sampling will be performed by the Contractor to characterize the soil for disposal purposes. It is anticipated that one composite sample will be collected from each stockpile. The composite samples will consist of grab samples (aliquots) collected from at least 5 randomly-located areas from each removal stockpile. Each aliquot will be collected using trowels, hand augers, and/or shovels. The aliquots will be placed in a mixing bowl and homogenized to generate one composite sample that represents the entire stockpile. Standard sampling and decontamination procedures, which will be followed in the field, are described in Sections 2.2 and 2.3.1. The waste characterization samples will be sent to an approved off-site laboratory for analysis of TCLP lead or any other analyte required by the disposal facility and local, state, and federal regulations. If the sample result exceeds 5.0 mg/L lead, the stockpile will be stabilized on-site by the Contractor and retested. If the sample result is less than or equal to 5.0 mg/L, the material will not require treatment.

2.1.1.4 **In-Situ Characterization Sampling**

In addition to the proposed soil stockpile soil characterization, in-situ characterization sampling may be performed. In-situ characterization will be utilized if the Contractor prefers to transport the excavated soil directly to the disposal facility. This will consist of determining the need for removal from a localized area within an area scheduled for removal. A removal area will consist of one or more properties based on proximity of the properties being remediated. The composite samples will consist of grab samples (aliquots) collected from at least 5 randomly-located areas about each removal area. Each aliquot will be collected from the ground surface to the excavation depth (determined from initial delineation sampling) using trowels, hand augers, and/or shovels. The aliquots will be placed in a mixing bowl and homogenized to generate one composite sample that represents the entire removal area. The waste characterization samples will be sent to an approved

off-site laboratory for analysis of TCLP lead. If the sample result exceeds 5.0 mg/L lead, the excavated soil will be placed in the soil staging area and the stockpile characterization sampling will be implemented. If the sample result is less than or equal to 5.0 mg/L, the material will not require treatment and could then be loaded onto trucks for direct transport to the disposal facility.

2.1.1.5 **Soil Stabilization/Treatment**

In the event that soil stabilization/treatment is warranted, the soil stockpile will be stabilized in the soil staging area. The stabilization process will be accomplished by a pug mill or mechanical means (e.g., trackhoe mixing within a contained area). The stabilization reagent and mixture ratios will be determined by the Contractor based on several effective proprietary and non-proprietary reagents and processes available on the market. Following stabilization of the stockpile, an additional sample will be collected following the procedures in section 3.4.1 and sent to the approved laboratory. If the sample result is below 5.0 mg/L TCLP lead, the soil is ready for off-site disposal. If, following treatment, the sample exceeds 5.0 mg/L TCLP lead, the stabilization and sampling process will be repeated until a passing TCLP result is achieved.

Any additional stabilization treatment requirements, if applicable, should be identified by USEPA or IEPA prior to work plan finalization.

2.2 SAMPLING METHODS

A summary of all samples to be collected is presented in Table QAPP-3. For each of the sampling areas, similar sampling methods will be employed. Each sampling method is detailed below and references the areas where they will be utilized.

2.2.1 Bulk XRF Analysis

For the RA properties, bulk soil analysis will be performed using an XRF. The bulk analysis consists of placing the XRF unit on the ground surface on bare soil operating in bulk sample mode. The XRF analyzes the soil for a period of 60 nominal seconds at a minimum. The XRF unit assigns a number ID to each analysis and records the data in its memory for download into a computer at a later date. The numerical ID increasing by one for each analysis performed.

2.2.2 Composite Soil Sampling

Two Composites will be collected per each EA. One composite will be collected for the A horizon (0-6 inches below ground surface (bgs)). The second composite will be collected for the B horizon (6-15 inches (bgs)). The locations of the aliquots will be equally spaced to develop a single sample representative of the entire EA. The samples will then be homogenized and a representative sample will be placed in a re-sealable plastic bag or testing cylinder. An X-Ray Fluorescence Analyzer (XRF) will then be used to determine the total lead concentrations for each composite.

The location of the discrete soil samples in each yard/EA will be equally spaced throughout the yard/EA. The QA Official will choose the sample locations on a lot by lot basis ensuring that the entire yard/EA is represented.

The individual discrete sample locations will be located to minimize contributions from other sources of lead based on the following protocols:

1. Soil samples will be collected at a minimum of 10 feet from painted permanent structures, roads and driveways in order to minimize contributions from other potential sources of lead;

2. Samples will be collected at a minimum of 5 feet from down-spouts and drainage features;

3. Samples will be collected at a minimum of 5 feet from potential yard specific contamination sources, i.e., trash burning areas, barbecues, waste storage areas, etc;

4. Samples will not be collected beneath asphalt, concrete or crushed stone/gravel paved areas.

Each discrete sample will be composited with the other discrete samples from the same depth increment to form the sample to be tested by the XRF. Any existing vegetative cover will be carefully removed and loose dirt from the root mat will be placed into the sample mixing bowl. Following completion of the sampling, the area will be filled with clean topsoil and the vegetative cover returned.

The soil sample will be placed into the mixing bowl and will be homogenized for two minutes, at a minimum. The composite sample will then be placed into a labeled resealable plastic bag or testing cylinder.

2.3 SAMPLE HANDLING AND CUSTODY

2.3.1 Soil Sampling Decontamination

The sampling methods prescribed herein have been developed to minimize the possibility of cross-contamination. Those sampling implements which cannot be decontaminated effectively shall be disposed of between and after sample collection. Decontamination procedures for sampling equipment will be as follows:

- Remove particulate matter and surface films with tap water, Alconox and brush as necessary;
- Tap water rinse;
- Deionized water rinse;
- Rinse with deionized water;
- Air dry (if possible); and
- Cover with plastic or wrap in aluminum foil if stored overnight.

Equipment blanks will be collected for decontamination quality assurance. A description of the types and frequency of QC samples is included in Section 2.5.

Any deviations from these procedures will be documented in the field logbook.

All derived wastes from each sampling event will be returned to the ground in the direct vicinity of the sample collection point.

2.3.2 Field Sampling Documentation Procedures

Field sampling operations and procedures will be documented by on-site personnel in bound field logbooks. Where appropriate, field operations and procedures will be photographed. Documentation of sampling operations and procedures will include documenting:

- Procedures for preparation of reagents or supplies which become an integral part of the sample (e.g., preservatives and absorbing reagents);
- Procedures for recording the exact location and specific considerations associated with sampling acquisition;
- Specific sample preservation method;
- Calibration of field instruments;
- Submission of field-based blanks, where appropriate;

- Potential interferences present at the Site;
- Field sampling equipment and containers including specific identification numbers of equipment;
- Sampling order;
- Decontamination procedures; and
- Field personnel.

Field logbooks will be waterproof and bound. The logbook will be dedicated to the job. No pages will be removed. Corrections will be made by drawing a single line through the incorrect data and initialing and dating the correction that was made to the side of the error. An initialed diagonal line will be used to indicate the end of an entry or the end of the day's activities. Photographs of field sampling operations and procedures will be documented in the field logbooks.

2.3.3 Sample Containers and Preservation

Table QAPP-4 lists the appropriated sample containers, preservation methods, and holding times for sample analysis. Samples will be labeled in the field according to the procedures outlined in Section 2.3.4.3 of this Appendix.

2.3.4 Sample Custody

Sample identification and chain-of-custody shall be maintained for the Site through the following chain-of-custody procedures and documentation:

- Sample labels, which prevent misidentification of samples;

- Custody seals to preserve the integrity of the sample from the time it is collected until it is opened in the laboratory;

- Field logbooks to record information about the site investigation and sample collection;

- Chain-of-Custody records to establish the documentation necessary to trace sample possession from the time of collection to laboratory analysis; and

- Laboratory logbooks and analysis notebooks, which are maintained at the laboratory to record all pertinent information about the sample.

The purpose of these procedures is to insure that the quality of the sample is maintained during its collection, transportation, storage and analysis. All chain-of-custody requirements shall comply with standard operating procedures indicated in the EPA sample handling protocol. All sample control and chain-of-custody procedures applicable to the subcontracted laboratory will be presented in the laboratory's procedures.

2.3.4.1 **Chain-of-Custody**

A sample is in custody if it is in someone's physical possession or view, locked up or kept in a secure area that is restricted to authorized personnel. The chain-of-custody record must be completed by the person responsible for sample shipment to the subcontracting laboratory. All constraints on time and analytical procedures should be marked on the record. The custody record should also indicate any special preservation or filtering techniques required by the laboratory. Figure QAPP-2 depicts a typical chain-of-custody record.

As few persons as possible should handle samples in the field. The sample collector is personally responsible for the care and custody of samples collected until they are transferred to another person.

The Site team leader will determine whether proper custody procedures were followed during field work and decide if additional samples are required.

2.3.4.2 **Sample Labels**

Identification labels are to be attached to the field sample containers. The labels shall not obscure any QA/QC lot numbers on the bottles. Sample information will be printed on the label in a legible manner using waterproof ink. The identification on the label must be sufficient to enable cross-reference with the logbook. Figure QAPP-3 depicts a field sample label.

Samples collected from each location, other than those collected for on-site field measurements or analyses, shall be identified by using a standard label which is attached to the sample container. The following information shall be included on the sample label:

- Site name;
- Date and time of sample collections;
- Designation of the sample (i.e., grab or composite);
- Type of sample with brief description of sampling location (depth);
- Signature of sampler;
- Sample preservative used; and
- General types of analyses to be conducted.

2.3.4.3 **Custody Seals**

Custody seals are preprinted adhesive-backed seals. Seals are placed on all shipping containers, and seals shall be signed and dated before use.

2.3.5 Transfer of Custody and Shipment

Chain-of-Custody records must be kept with the samples at all times. When transferring the samples, the parties relinquishing and receiving them must sign, date, and note the time on the record. Each shipment of samples to the laboratory must have its own Chain-of-Custody record with the contents of the shipment, method of shipment, name of courier, and other pertinent information written on the record. The original record accompanies the shipment and the copies are distributed to the AGC Project Director. Freight bills, postal service receipts and bills of lading are retained as permanent documentation.

2.4 ANALYTICAL METHODS

2.4.1 Composite Sampling Analysis

Composite samples will be analyzed by an on-site XRF laboratory or sent to STL - Chicago for analysis. The soil will be placed into a sample container, and analyzed for total lead (in bulk mode) by the XRF. The sample that was analyzed by XRF will be placed in a labeled resealable plastic bag or testing cylinder, along with the chain-of-custody form, and archived in a locked location and/or under custody seal.

2.4.2 Off-Site Laboratory Analysis

Five percent (5%) of the on-site composite XRF soil samples will be randomly split and analyzed by STL-Chicago (EPA SW-846 Method 6010B) to compare with the XRF measurements. Those samples that are sent to the laboratory will be placed into a laboratory-provided sample container labeled (Figure QAPP-2) listing the sample ID, date and time collected, analysis and method, and the initials of the sampler.

2.5 QUALITY CONTROL

Field QC samples will be collected to determine if contamination of samples has occurred in the field and, if possible, to quantify the extent of contamination so that data are not lost. Duplicate samples, equipment blanks and matrix spike/matrix spike duplicate (MS/MD) samples will also be collected. The duplicate QC samples will be labeled with fictitious identification locations and times, and submitted to the laboratory as regular samples. The actual identification of the duplicate QC samples will be recorded in the field logbook. The samples will be identified as field duplicate, equipment blank, and MS/MSD samples in the final report.

2.5.1 Field Duplicate Samples

Field duplicate samples are independent samples collected in such a manner that they are equally representative of the sampling point and parameters of interest at a given point in space and time. Field duplicate samples provide precision information of homogeneity, handling, shipping, storage, preparation and analysis.

Soil sample field duplicates will be collected and homogenized before being split. Field duplicate samples will be analyzed with the original field samples for the same parameters. One of every twenty investigative samples collected will be duplicated. In addition, one of every twenty samples analyzed by the mobile laboratory will be duplicated.

2.5.2 Equipment Blanks

The equipment (rinsate) blank is designed to address cross-contamination between sample sources in the field due to deficient field equipment decontamination procedures. This blank also addresses field preservation procedures, environmental Site interference and the integrity of the source water for field cleaning.

An equipment blank will be prepared during soil sampling when a particular piece of sampling equipment was employed for sample collection and subsequently decontaminated in the field for use in additional sampling. The equipment blank will be composed in the field by collecting, in the appropriate container for the water, a blank water rinse from the equipment (spoon, auger, corer, etc.) after execution of the last step of the proper field decontamination protocol. Preservatives or additives will be added to the equipment blank where appropriate for the sampling parameters. One equipment blank will be collected per 20 samples collected and sent to the off-site lab for lead analysis.

2.5.3 Matrix Spike/Matrix Spike Duplicate Samples

MS and MSDs will be collected from the same location as the parent sample and will be analyzed for the same parameters as the parent sample. Each sample will be labeled with the sample number as the original sample, designated as MS or MSD samples, and submitted to the laboratory for the appropriate analyses. MS/MSD samples determine accuracy by the recovery rates of the compounds added by the laboratory (the MS compounds are defined in the analytical methods). The MS/MSD samples also monitor any possible matrix effects specific to samples collected from the Site and the extraction/digestion efficiency. In addition, the analysis of MS and MSD samples check precision by comparison of the two spike recoveries. One MS and MSD sample will be collected for every 20 samples collected and sent to the off-site lab for analysis.

2.6 INSTRUMENT/EQUIPMENT TESTING, INSPECTION, AND MAINTENANCE

2.6.1 Field Equipment

Field measurement equipment and the XRF unit will be maintained in accordance with manufacturer's instructions. All field equipment will be checked by qualified technicians prior to use

in the field. The instrument operator will be responsible for operating the equipment properly in the field. Any problems encountered while operating the instrument will be documented in the field logbook. If problem equipment is detected or should require service, the equipment will be returned and a qualified technician will perform the maintenance required. Use of the instrument will not be resumed until the problem is resolved. Routine maintenance of field instruments will be documented in the field logbooks.

2.6.2 Laboratory Equipment

Preventative maintenance and periodic maintenance is performed as recommended by the manufacturers of the equipment in use in the laboratory. Spare parts are kept in inventory to allow for minor maintenance. Service contracts are maintained for most major instruments, balances and critical equipment. If an instrument fails, the problem will be diagnosed as quickly as possible, and either replacement parts will be ordered or a service call will be placed.

Laboratory logbooks are kept by the laboratory to track the performance maintenance history of all major pieces of equipment. The instrument maintenance logbooks are available for review upon request. Specific details of preventative maintenance programs for the laboratory will be provided in the Laboratory QAM.

2.7 INSTRUMENT/EQUIPMENT CALIBRATION AND FREQUENCY

2.7.1 Laboratory Calibration

Laboratory calibration and frequency is specified in the EPA SW-846 Method 6010B is summarized in the STL QAM.

2.7.2 Field Calibration

All instruments and equipment used during sampling and analysis will be operated, calibrated, and maintained according to the manufacturer's guidelines and recommendations. Operation, calibration and maintenance will be performed by trained personnel on a daily basis. All maintenance and calibration information will be documented and will be available upon request.

2.8 INSPECTION/ACCEPTANCE OF SUPPLIES AND CONSUMABLES

Supplies and consumables are inspected upon receipt to check for damage during shipment, to confirm that no potential cross contamination occurred, and to confirm the items ordered were shipped. Spare and replacement parts stored at the AGC office equipment room and/or in the AGC company truck to minimize downtime include the following:

- Appropriately sized batteries
- Locks
- Extra sample containers
- Extra samples coolers, packing material, and sample location stakes.
- Additional supply of health and safety equipment, i.e., respirator cartridges, boots, gloves, tyvek, etc.
- Additional equipment as necessary for the field tasks.

2.9 NON-DIRECT MEASUREMENTS

There will not be any non-direct measurements.

2.10 DATA MANAGEMENT

All field data is documented in bound, pre-page numbered logbooks. Once a logbook has been filled, the logbook is returned to the office and filed in the project files. Samples collected are documented in the logbook and on the Chain-of-Custody for submittal to the laboratory.

All laboratory data is submitted to AGC in both a hard copy sample delivery group (SDG) and as an electronic data deliverable (EDD). The hard copy SDG is used for the validation of the data and after validation it is placed in a project-specific archive box, a unique archive number assigned and archived.

A copy of the Chain-of-Custody is used to hand enter the sample identification into the database. All hand entries are 100% checked and validated by the QA Manager or another designated individual who did not enter the Chain-of-Custody originally. The EDD is used to enter the analytical results into the database. No modification of the data is made to the EDD. Once the field data and laboratory data has been entered into the database, tables are made for use in the validation of the data. Through the process of data validation, the tables are checked to the laboratory Form 1's to confirm that the EDD was accurate.

Any qualifiers assigned during the data validation are entered by the QA Scientist and 100% checked by the QA Manager or another designated individual who did not enter the qualifiers.

Electronic copies of all data shall be made available to USEPA and IEPA upon request by the agencies.

3.0 ASSESSMENTS AND OVERSIGHT ELEMENTS

3.1 ASSESSMENTS AND RESPONSE ACTIONS

3.1.1 Laboratory Assessments

The purpose of a quality assurance audit is to provide an objective, independent assessment of a measurement effort. The quality assurance audit ensures that the laboratory's data generating, data gathering, and measurement activities produce reliable and valid results. There are two forms of quality assurance audits: performance evaluation audits and system audits.

3.1.1.1 **Performance Evaluation Audits**

The purpose of performance evaluation audits is to quantitatively measure the quality of the data. These audits provide a direct evaluation of the various measurement systems' capabilities to generate quality data.

The laboratory regularly participates in performance evaluation audits as part of their laboratory certification efforts. Performance audits are conducted by introducing control samples in addition to those routinely used.

The results of the performance audits are summarized and maintained by the Laboratory QA Supervisor and distributed to the section supervisors who must investigate and respond to any out of control results.

3.1.1.2 **Technical System Audits**

A technical systems audit is an on-site, qualitative review of the various aspects of a total sampling and/or analytical system. The purpose of the technical systems audit is to assess the overall effectiveness, through an objective evaluation, of a set of interactive systems with respect to strength, deficiencies, and potential areas of concern. Typically, the audit consists of observations and documentation of all aspects of sample analyses. External and internal audits are conducted of the laboratory throughout each year.

3.1.2 Field Assessments

The purpose of the field audits is to confirm that field sampling, documentation, and analytical procedures are being performed in accordance with the Work Plan. Additionally, the field audits confirm that the field crew is performing the procedures consistently.

Formal field audits will be performed during the composite sampling. Formal audits will be performed periodically and will consist of the sampling team manager (or higher rank) observing the sampling crew perform a sampling, documentation, and/or analytical event. The formal audits will be unannounced to the field crew and will be documented in the field log books or daily reports.

3.1.3 Response Actions

When field sampling activities or laboratory QC results show the need for corrective action, immediate action will take place and will be properly documented. In the event that a problem arises, corrective action will be implemented. Any error or problem will be corrected by an appropriate action which may include:

- Replacing or repairing a faulty measurement system;
- Discarding erroneous data;
- Collecting new data; and
- Accepting the data and acknowledging a level of uncertainty.

3.1.3.1 **Field Sampling Response Actions**

The QA Official will be responsible for all field QA. Any out of protocol occurrence discovered during field sampling will be documented in the field logbook and immediate corrective action will be taken. For problems or situations which cannot be solved through immediate corrective action, the QA Official will immediately notify the Project Director, the Project Manager and/or the QA Manager. The Project Director, the Project Manager and/or the QA Manager and QA Official will investigate the situation and determine who will be responsible for implementing the corrective action. Corrective action will be implemented upon approval by the Project Director and/or the QA Manager. The Project Manager will verify that the corrective action has been taken, appears effective, and at a later date, verify that the problem has been resolved. The successfully implemented corrective action will be documented in the field logbook by the QA Official. Any deviations from the QA protocol in the QAPP must be justified, approved by the Project Director and/or the QA Manager (and the EPA, if necessary), and properly documented.

3.1.3.2 **Laboratory Situation Response Actions**

Corrective action will be implemented to correct discrepancies found which affect the validity or quality of analytical data, and to identify any analytical data that may have been affected. Limits of data acceptability for each parameter and sample matrix are addressed in the instrument manuals, EPA Methods and/or Laboratory QA Manual. Whenever possible, immediate corrective action procedures will be employed. All analyst corrective actions are to be followed according to the

instrument manuals, EPA Methods, or Laboratory QA Manual. Any corrective action performed by the analyst will be noted in laboratory logbooks.

Laboratory personnel noting a situation or problem which cannot be solved through immediate corrective action will notify the Laboratory QA Supervisor. The QA Supervisor will investigate the extent of the problem and its effect on the analytical data generated while the deficiency existed. All data suspected of being affected will be scrutinized to determine the impact of the problem on the quality of the data. If it is determined that the deficiency had no impact on the data, this finding will be documented. If the quality of the analytical data were affected, the Laboratory Program Manager and AGC QA Manager will be notified immediately so that courses of action may be identified to determine how to rectify the situation.

The laboratory must take corrective action if any of the QC data generated during the laboratory analyses are outside of the method criteria. Corrective action for out-of-control calibrations is to recalibrate the instrument and reanalyze the samples. A sequence is specified in the EPA specified methods when problems in analyses are encountered. The laboratory will follow these procedures exactly and document the problems encountered and the corrective action in a case narrative enclosed with each data deliverables package.

The Laboratory QA Supervisor will be responsible for informing the Laboratory Program Manager and AGC QA Manager of the effects on the data, the data affected and the corrective action taken. It is also the Laboratory QA Supervisor's responsibility to verify that the corrective action was performed, appears effective, and at a later date, the problem was resolved.

3.1.3.3 **Data Validation QA Response Actions**

Upon completion, sample data packages will be sent from the laboratory to the AGC QA Scientist for data validation. If all project samples are not present in the data packages or any deficiencies

affecting the sample results are noted, the QA Scientist will contact the Laboratory QA Supervisor. The Laboratory QA Supervisor will respond in writing to any inquiries and provide any changes to the data packages to the QA Scientist. Any errors, problems, questionable data values, or data values outside of established control limits will be corrected by the appropriate action which may include disregarding erroneous data, collecting new data, and accepting the data and acknowledging a level of uncertainty. The data validation report will provide a description of the usability of the data.

3.2 REPORTS TO MANAGEMENT

Data validation reports, along with copies of all support documentation, validated data summary tables, and analytical data packages, will be submitted periodically as data are validated.

4.0 DATA VALIDATION AND USABILITY

4.1 DATA REVIEW, VERIFICATION, AND VALIDATION

All analytical data will be permanent, complete and retrievable. The analyst will enter the analytical data into the Laboratory Information Management System (LIMS) upon analysis completion and laboratory validation. The laboratory will report sample results on analysis report forms and provide the information referenced in the EPA Methods for each deliverables package. All laboratory data will undergo the data validation procedures described in the Laboratory QA Manual prior to final reporting. Data will be stored on the laboratory's network until the investigation is complete and data archived from the LIMS will be transferred to magnetic tape which will be retained by the laboratory for an additional five years.

All lead results will be reported in milligrams per liter (mg/l) for aqueous samples or milligrams per kilogram (mg/kg) for solid samples. Equations to calculate concentrations are found in the EPA SW-846 Method 6010B. All blank results and QC data will be included in the data deliverables package. Blank results will not be subtracted from the sample results. The blank results and QC data will be used in data validation to review sample results qualitatively. Data validation will be performed for samples analyzed at the off-site laboratory in general accordance with the guidelines identified in Section 4.2. Outliers and other questionable data will be addressed in the data validation report and specific QA/QC flags will be applied to questionable data. The QA/QC flags will be consistent with the EPA data validation guidelines.

All analytical data, reports, and any other project related information produced during this project will be stored in the project file at AGC's office maintained by the Project Director. Project reports, tables, etc. will be stored in project specific electronic files. On a regular basis, the data will be backed up on magnetic tapes and stored off-site.

4.2 VERIFICATION AND VALIDATION METHODS

Validation of analytical data as received from the off-site laboratory will be performed by an AGC QA Scientist. Validation will be performed in general accordance with the USEPA Region 5 Standard Operating Procedure for Validation of CLP Inorganic Data (1993).

Specifically the information examined will consist of sample results, analytical holding times, sample preservation, chains-of-custody, initial and continuing calibrations, field and laboratory blank analysis results, serial dilutions, instrument performance check sample results, MS/MSD recoveries and RPD, laboratory control sample recoveries, and field duplicate recoveries. If the criteria listed in the analytical method are not met for any parameter the associated samples will be flagged as described in the referenced validation guidelines. During data validation, data is also reviewed for transcription, calculation, and reporting errors. Calculations for obtaining concentration data for all parameters may be found in the referenced methods.

The purpose of data validation is to verify and retrace the path of the sample from the time of receipt for analysis to the time the final data package report is generated. Upon completion of data validation, the existing results will be reported in tabular form with data validation flags applied as appropriate to determine the usefulness of the data. The data validation flags will be consistent with the EPA data validation guidelines. A data validation report will be written to assist the Project Director in making decisions based on the analytical results. Laboratory data packages and data validation reports will be provided to EPA at its request.

4.3 RECONCILIATION WITH USER REQUIREMENTS

Completeness will be calculated to reconcile the useable validated data to the entire data set. A completeness of 90% or greater is required for the project.

TABLES

TABLE QAPP-1
ACCEPTANCE CRITERIA
St. Louis Smelting and Refining Site

DQO PARAMETER	SOIL
Field Criteria	
Equipment Blank	<RL
Matrix Spike/Matrix Spike Duplicate	75-125%
Field Duplicate	<40% RPD for results >5xRL
	<+/- 2xRL for results < 5xRL
Laboratory Criteria	
Method Blank	<RL
Matrix Spike/Matrix Spike Duplicate	75-125%
Laboratory Control Sample	75-125%

RPD: relative percent difference
RL: reporting limit

TABLE QAPP-2
ANALYTICAL METHODS AND LABORATORY LIMITS OF DETECTION
St. Louis Smelting and Refining Site

PARAMETER	UNITS	CRITERIA	REPORTING LIMIT	ANALYTICAL METHOD
TCLP Volatiles				
Benzene	mg/L	0.5	0.002	SW-846 8260B
Carbon Tetrachloride	mg/L	0.5	0.004	SW-846 8260B
Chlorobenzene	mg/L	100	0.01	SW-846 8260B
Chloroform	mg/L	6	0.01	SW-846 8260B
1,2-Dichloroethane	mg/L	0.5	0.004	SW-846 8260B
1,1-Dichloroethene	mg/L	0.7	0.004	SW-846 8260B
Methyl Ethyl Ketone	mg/L	200	0.01	SW-846 8260B
Tetrachloroethene	mg/L	0.7	0.002	SW-846 8260B
Trichloroethene	mg/L	0.5	0.002	SW-846 8260B
Vinyl Chloride	mg/L	0.2	0.01	SW-846 8260B
TCLP Semivolatiles				
2-Methylphenol	mg/L	200	0.04	SW-846 8270C
3-Methylphenol	mg/L	200	0.04	SW-846 8270C
4-Methylphenol	mg/L	200	0.04	SW-846 8270C
Phenol	mg/L	200	0.04	SW-846 8270C
1,4-Dichlorobenzene	mg/L	7.5	0.04	SW-846 8270C
2,4-Dinitrotoluene	mg/L	0.13	0.008	SW-846 8270C
Hexachlorobenzene	mg/L	0.13	0.004	SW-846 8270C
Hexachlorobutadiene	mg/L	5	0.008	SW-846 8270C
Hexachloroethane	mg/L	3	0.004	SW-846 8270C
Nitrobenzene	mg/L	2	0.004	SW-846 8270C
Pentachlorophenol	mg/L	100	0.16	SW-846 8270C
Pyridine	mg/L	5	0.04	SW-846 8270C
2,4,5-Trichlorphenol	mg/L	400	0.04	SW-846 8270C
2,4,6-Trichlorophenol	mg/L	2	0.04	SW-846 8270C
TCLP Pesticides				
Chlordane	mg/L	0.03	0.00056	SW-846 8081
Endrin	mg/L	0.02	0.000056	SW-846 8081
Heptachlor	mg/L	0.008	0.000056	SW-846 8081
Lindane	mg/L	0.4	0.000056	SW-846 8081
Methoxychlor	mg/L	10	0.000056	SW-846 8081
Toxaphene	mg/L	0.5	0.00056	SW-846 8081
TCLP Herbicides				
2,4-D	mg/L	10	0.00056	SW-846 8151A
2,4,5-TP	mg/L	1	0.00056	SW-846 8151A
Metals				
Lead	mg/kg	1200	0.5	SW-846 6010B
TCLP Metals				
Arsenic	mg/L	5	0.016	SW-846 1312/6010B
Barium	mg/L	100	0.0085	SW-846 1312/6010B
Cadmium	mg/L	1	0.002	SW-846 1312/6010B
Chromium	mg/L	5	0.008	SW-846 1312/6010B
Lead	mg/L	5	0.011	SW-846 1312/6010B
Mercury	mg/L	0.2	0.0001	SW-846 7471
Selenium	mg/L	1	0.021	SW-846 1312/6010B
Silver	mg/L	5	0.007	SW-846 1312/6010B
Conventionals				
Corrosivity	unitless	2 - 12.5	NA	MCAWW 150.1
Total Phenols	mg/kg	NA	0.005	MCAWW 420.1
Reactive Sulfide	mg/kg	see 40CFR261	20	40 CFR 261
Reactive Cyanide	mg/kg	see 40CFR261	25	40 CFR 261
Paint Filter	unitless	NA	NA	SW-846 9095A
Ignitability	°F	<140°F	NA	40 CFR 261

SW-846 - USEPA SW-846 Test Methods for Evaluating Solid Waste Physical/Chemical Methods
MCAWW - Methods for Chemical Analysis of Water and Wastes
NA - Not applicable

TABLE QAPP-3
SUMMARY OF ALL SAMPLING AND ANALYSIS
St. Louis Smelting and Refining Site

Location	Matrix	# of Samples	# of EBs	# of FDs	# of MS/MSDs	Analyses
RA Properties	Soil	5% of total samples collected	1/20	1/20	1/20	Lead
Waste Characterization	Soil	TBD	1/20	1/20	1/20	TCLP Organics, TCLP Metals, corrosivity, reactivity, ignitability, paint filter, total phenolics
Stockpiles	Soil	TBD	1/20	1/20	1/20	TCLP Lead
In-Situ Characterization	Soil	TBD	1/20	1/20	1/20	TCLP Lead
Stabilization/Treatment	Soil	TBD	1/20	1/20	1/20	TCLP Lead

Notes:

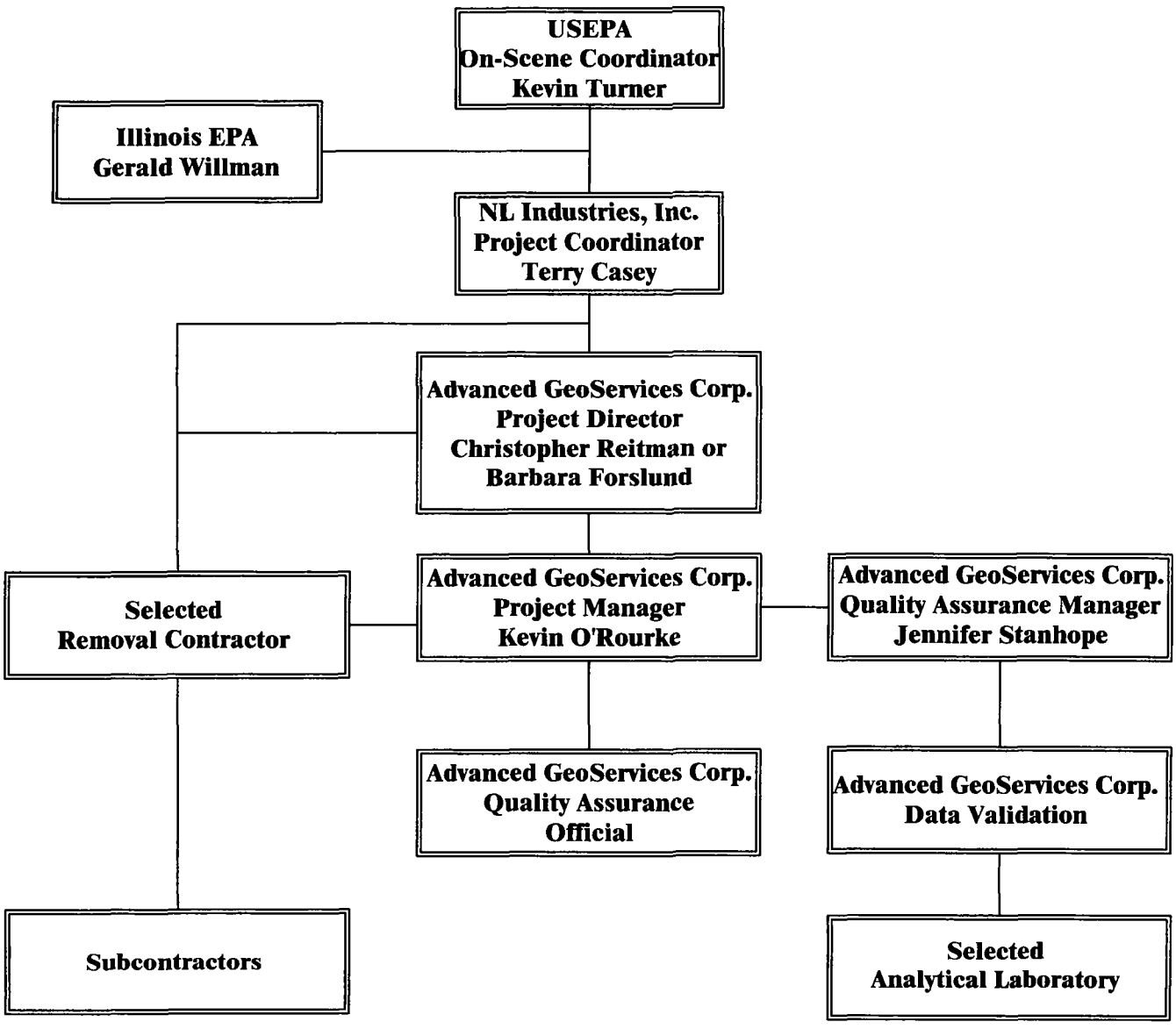
EB	Equipment blank, one per matrix per day when non-dedicated or disposable equipment is used
FD	Field duplicate, one per matrix per twenty samples
MS/MSD	Matrix spike/matrix spike duplicate, one per matrix per twenty samples
TCLP	Toxicity Characteristic Leaching Procedure
TBD	To be determined

TABLE QAPP-4
ANALYTICAL METHODS AND SAMPLE COLLECTION REQUIREMENTS
St. Louis Smelting and Refining Site

Matrix	Parameter	Method	Container	Preservative	Holding Time Limit
Soil	TCLP Volatiles	SW-846 8260B	16 oz Glass	4°±2°C	14 Days
	TCLP Semivolatiles	SW-846 8270C		4°±2°C	14 Days
	TCLP Pesticides	SW-846 8081		4°±2°C	14 Days
	TCLP Herbicides	SW-846 8151A		4°±2°C	14 Days
	TCLP Metals	SW-846 6010B/7471	4oz Glass	None	6 Months (26 Days-Hg)
	Lead	SW-846 6010B	4oz Glass	None	6 Months
	Corrosivity	MCAWW 150.1	16 oz Glass	None	14 Days
	Reactivity	40 CFR 261		None	7 Days
	Ignitability	40 CFR 261		None	None
	Paint Filter	SW-846 9095A		None	None
	Total Phenolics	MCAWW 420.1	4oz Glass	4°±2°C	28 Days

SW-846 - USEPA SW-846 Test Methods for Evaluating Solid Waste Physical/Chemical Methods
MCAWW - Methods for Chemical Analysis of Water and Wastes

FIGURES



ST. LOUIS SMELTING AND REFINING SITE

COLLINSVILLE, ILLINOIS

Scale: NO SCALE	PROJECT ORGANIZATION
Originated By: KO	
Drawn By:	
Checked By: KO	
Project Mgr: CTR	
Dwg No. 2003-1055-01-09	
Issued:	

Advanced GeoServices Corp.
1055 Andrew Drive, Suite A
West Chester, Pennsylvania 19380
(610) 840-9100
FAX: (610) 840-9199

Project No. 2003-1055-01

FIGURE: QAPP-1

J:\Collinsville Smelter\drawings\2003-1055-01\2003-1055-01-09

1055 Andrew Drive, Suite A
West Chester, Pennsylvania 19380
PHONE: (610) 840-9100
FAX: (610) 840-9199

ADVANCED GEOSERVICES CORP.
CHAIN OF CUSTODY

page ____ of ____

Project Name: _____ Project No: _____

AGC Contact Person: _____ Shipment No: _____

Laboratory Name/Location: _____

Sampler's Name(s) (Print): _____

Sample ID/Location	Date Collected	Time Collected	Sample Type: Comp	Sample Type: Grab	Sample Matrix	Field Filtered: Yes	Field Filtered: No	Total Number of Containers	Analysis Requested								Preservatives: H_2SO_4	Preservatives: HCL	Preservatives: HNO_3	Preservatives: NAOH	Preservatives: NONE	Remarks

Turnaround time (circle one): Standard 5-7 Days (Rush) 2-4 Days (Rush) 24 Hours (Rush)

Deliverables (circle one): Results Only Results/QC Summary CLP-Like CLP NJ/CLP NJ/CLPII Other _____

Relinquished by:	Date/Time:	Received by:	Date/Time:
Relinquished by:	Date/Time:	Received by:	Date/Time:
Relinquished by:	Date/Time:	Received by:	Date/Time:
Relinquished by:	Date/Time:	Received by:	Date/Time:
Relinquished by:	Date/Time:	Received by:	Date/Time:

Sample Matrix: SW - Surface Water, GW - Groundwater, Sed - Sediment, S- Soil, Sld - Sludge

ST. LOUIS SMELTING AND REFINING SITE

COLLINSVILLE, ILLINOIS

Scale: NO SCALE	PROJECT ORGANIZATION
Originated By: J.M.S.	
Drawn By:	
Checked By: J.M.S.	Advanced GeoServices Corp. 1055 Andrew Drive, Suite A West Chester, Pennsylvania 19380 (610) 840-9100 FAX: (610) 840-9199
Project Mgr: C.T.R	
Dwg No. 2003-1118-17	Project No 2003-1118-01
Issued MAY 18 2004	FIGURE: QAPP-2

J:\Collinsville Smelter\drawings\2003-1118\2003-1118-17

ADVANCED GEOSERVICES CORP. 1055 Andrew Drive, Suite A West Chester, Pennsylvania 19380 (610) 840-9100 FAX: (610) 840-9199	PROJECT NO. _____
SAMPLE IDENTIFICATION NUMBER	REMARKS:
COLLECTION INFORMATION ☐ COMPOSITE ☐ GRAB DATE: TIME: BY:	
TESTING REQUIRED	PRESERVATIVES ADDED
RECEIVING LAB	LAB SAMPLE NO.

ST. LOUIS SMELTING AND REFINING SITE

COLLINSVILLE, ILLINOIS

Scale: N.T.S.	SAMPLE LABEL
Originated By:	
Drawn By:	
Checked By: KO	Advanced GeoServices Corp. 1055 Andrew Drive, Suite A West Chester, Pennsylvania 19380 (610) 840-9100 FAX: (610) 840-9199
Project Mgr: CTR	
Dwg No. 2003-1055-01-16	
Issued: MAY 18 2004	Project No 2003-1055 — FIGURE: QAPP-3

J:\Collinsville\drawings\2003-1055-01\2003-1055-01-16

ATTACHMENT 1

RESUME QUALITY ASSURANCE MANAGER

JENNIFER M. STANHOPE
Quality Assurance Manager

FIELDS OF EXPERTISE
Quality Assurance/Quality Control (QA/QC) Duties; Validation of Inorganic and Organic Data; Preparation and Implementation of Quality Assurance Project Plans (QAPPs); Overseer of Laboratory Subcontractor Analytical Services; Field and Laboratory Audits; Data Management and Data Coordination Duties; Supervisor of Field Technicians.

EDUCATION
Bachelor of Science - Environmental Chemistry; State University of New York, College of Environmental Science and Forestry, 1992.

PRESENT DUTIES AND RESPONSIBILITIES
Ms. Stanhope is the QA Manager responsible for the coordination, management, review, and validation of all analytical data (soil, aqueous, air, sediment, and other matrices); the interpretation and technical consultation of the data usability; preparation, documentation and implementation of QAPPs; and field and laboratory auditing for QA/QC compliance. Her responsibilities also include coordination with field personnel regarding QA/QC requirements and procedures and with subcontracted laboratories for analytical services. She is also the administrative supervisor for all AGC field technicians.

EXPERIENCE SUMMARY
Ms. Stanhope has been involved in the environmental consulting industry and laboratory services field since 1993. This experience has included interpretation of analytical data; generation of site specific sampling plans, QAPPs, and health and safety plans (HASPs); field data collection and environmental sampling; and field and laboratory auditing.

PROJECT EXPERIENCE

Data Validation of Organic and Inorganic Data. *Quality Assurance Manager* Reviewed and validated inorganic and organic data (aqueous, air, soil, sediment, other solids, and tissue) for numerous clients and over 10,000 samples using USEPA CLP National Functional Guidelines, USEPA Regional modifications to the National Functional Guidelines, and various state guidelines (Pennsylvania, New Jersey, Delaware, Ohio, North Carolina, Indiana, Florida, Tennessee, Illinois, Oregon, Washington, California, Idaho, and Alaska).

Analytical Laboratory Service Coordination. *Project Manager.* Provided environmental analytical quotes to over 30 clients (federal, state, and industrial) for local, national, and international sampling projects; reviewed all samples entered into the laboratory information management system (LIMs); provided excellent client service; CLP inorganic contact person for the laboratory; coordinated and reviewed in-house sample tracking; and prepared the final sample delivery group (data deliverable) individually tailored to the client's specifications.

Field and Laboratory Coordination. *Quality Assurance Manager.* Managed the QA/QC aspect of field sampling for a multitude of projects for various clients (USEPA, various states, and industrial clients) from the planning stage of sampling through the final reporting of the data. Assisted in planning sampling events, writing field sampling plans, quality assurance project plans, health and safety plans, contacted and arranged the laboratory for analytical analysis, arranged the bottle orders for field sampling, instructed the field samplers in the QA/QC procedures and sample requirements for sampling events, primary contact for the analytical laboratories and dealt with issues arising from cooler receipt, analysis, and data reporting.

Development of QAPPs and HASPs. *Quality Assurance Manager.* Prepared QAPPs and HASPs for several clients as per the guidelines and regulations provided by the USEPA including USEPA Regions, and several states (Indiana, Pennsylvania, Delaware, Indiana, New York, Ohio, New Jersey, and Louisiana) and provided comments and suggestions for improving numerous QAPPs and HASPs written by others.

CLP Sampling Coordinator. *Assistant Scientist.* Participated in a CLP sampling project in Oregon. Was responsible for filling out all required CLP paperwork (bottle labels, bottle tags, organic and inorganic chain-of-custodies, and custody seals).

ATTACHMENT 2

STL-CHICAGO

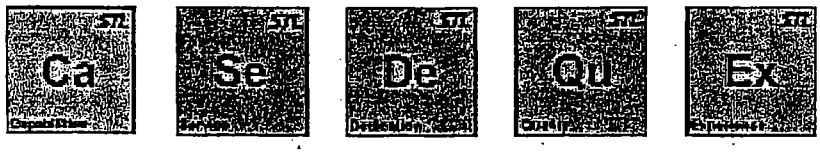
QUALITY ASSURANCE MANUAL

SEVERN TRENT SERVICES

SEVERN TRENT LABORATORIES

CORPORATE STATEMENT OF QUALIFICATIONS

SEPTEMBER 2000



Providing the Elements for your Success

SEVERN TRENT LABORATORIES

www.stl-inc.com

SEVERN TRENT SERVICES

SEVERN TRENT LABORATORIES

U.S. LABORATORY LOCATIONS

Alabama

STL Mobile
900 Lakeside Drive
Mobile, AL 36693
Tel: (334) 666-6633
Fax: (334) 666-6696

Alaska

STL Anchorage
5761 Silver
Suite N
Anchorage, AK 99518
Phone: 907-563-4800
Fax: 907-563-4815

California

STL Los Angeles
1721 South Grand Avenue
Santa Ana, CA 92705
Phone: 714-258-8610
Fax: 714-258-0921

STL Sacramento
880 Riverside Parkway
West Sacramento, CA
95605
Phone: 916-373-5600
Fax: 916-372-1059

Colorado

Advanced Analytical Services Group
4955 Yarrow Street
Arvada, CO 80002
Phone: 303-421-6611
Fax: 303-431-7171

STL Denver
4955 Yarrow Street
Arvada, CO 80002
Phone: 303-421-6611
Fax: 303-431-7171

Connecticut

STL Connecticut
128 Long Hill Cross Road
Shelton, CT 06484
(203) 929-8140
(203) 929-8142

Florida

STL Miami
10200 USA Today Way
Miramar, FL 33025
Tel: (954) 431-4550
Fax: (954) 431-1959

STL Pensacola
11 East Olive Road
Pensacola, FL 32514
Tel: (850) 474-1001
Fax: (850) 478-2671

STL Tallahassee
2846 Industrial Plaza Drive
Tallahassee, FL 32301
Tel: (850) 878-3994
Fax: (850) 878-9504

STL Tampa East
5910 H Breckenridge
Pkwy.
Tampa, FL 33610
Phone: 813-621-0784
Fax: 813-623-6021

STL Tampa West
6712 Benjamin Road, Suite
100
Tampa, FL 33634
Tel: (813) 885-7427
Fax: (813) 885-7049

Georgia

STL Savannah
5102 LaRoche Avenue
Savannah, GA 31404-6019
Tel: (912) 354-7858
Fax: (912) 351-3673

Illinois

STL Chicago
2417 Bond Street
University Park, IL 60466
Tel: (708) 534-5200
Fax: (708) 534-5211

Indiana

STL Valparaiso
2400 Cumberland Drive
Valparaiso, IN 46383
Phone: 219-464-2389
Fax: 219-462-2953

Maryland

STL Baltimore
19 Loveton Circle
Sparks, MD 21152
Tel: (410) 771-4920
Fax: (410) 771-4407

Massachusetts

STL Billerica
149 Rangeway Road
N. Billerica, MA 01862
Tel: (978) 667-1400
Fax: (978) 667-7871

STL Westfield
53 Southampton Road
Westfield, MA 01085
Tel: (413) 572-4000
Fax: (413) 572-3707

On-Site Technologies Division
53 Southampton Road
Westfield, MA 01085
Tel: (413) 572-4000
Fax: (413) 572-3707

Missouri

STL St. Louis
13715 Rider Trail North
Earth City, MO 63045
Phone: 314-298-8566
Fax: 314-298-8757

New Jersey

STL Edison
777 New Durham Road
Edison, NJ 08817
Tel: (732) 549-3900
Fax: (732) 549-3679

New York

STL Buffalo
10 Hazelwood Dr., Ste 106
Amherst, NY 14228
Tel: (716) 691-2600
Fax: (716) 691-7991

STL Newburgh
315 Fullerton Avenue
Newburgh, NY 12550
Tel: (914) 562-0890
Fax: (914) 562-0841

Ohio

STL North Canton
4101 Shuffel Drive NW
North Canton, OH 44720
Phone: 330-497-9396
Fax: 330-497-0772

Pennsylvania

STL Pittsburgh
450 William Pitt Way
Building 6
Pittsburgh, PA 15238
Phone: 412-820-8380
Fax: 412-820-2080

Tennessee

STL Knoxville
5815 Middlebrook Pike
Knoxville, TN 37921
Phone: 865-291-3000
Fax: 865-584-4315

Texas

STL Austin
14046 Summit Drive
Building B
Austin, TX 78728
Phone: 512-244-0855
Fax: 512-244-0160

STL Corpus Christi
1733 N. Padre Island Drive
Corpus Christi, TX 78408
Phone: 361-289-2673
Fax: 361-289-2471

STL Houston
6310 Rothway Drive
Suite 130
Houston, TX 77040
Tel: (713) 690-4444
Fax: (713) 690-5646

Vermont

STL Burlington
208 South Park Drive
Suite 1
Colchester, VT 05446
Tel: (802) 655-1203
Fax: (802) 655-1248

Washington

STL Richland
2800 George Washington
Way
Richland, WA 99352
Phone: 509-375-3131
Fax: 509-375-5590

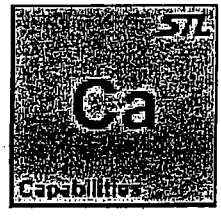
TABLE OF CONTENTS

TABLE OF CONTENTS (continued)

SEVERN TRENT SERVICES

SEVERN TRENT LABORATORIES

SECTION 1



COMPANY OVERVIEW

1.1 COMPANY OVERVIEW

Severn Trent Laboratories (STL) consists of 35 laboratory facilities; 29 in the United States and six in the United Kingdom. STL has grown in the U.S through the acquisitions of established, well managed, high quality and respected environmental analytical testing facilities. These laboratories have extensive experience with all matrices, methods, protocols and programs working on behalf of industry, commerce and government.

STL is a part of Severn Trent Services Inc. (STS), a major group of U.S. based companies with 5,000 employees throughout the U.S., Europe and Asia Pacific and annual revenues of $ 600 million. Both companies are owned by Severn Trent Plc., a $2 billion British water, waste and utility services company, one of the top 100 publicly traded companies in the United Kingdom, employing some 13,500 people.

The following table outlines the current number of sites and employees for STL's operations worldwide.

Table 1A - US & UK Facilities Overview

Location	# of Sites	# of Employees
US	29	2000
UK	6	435
Total	35	2435

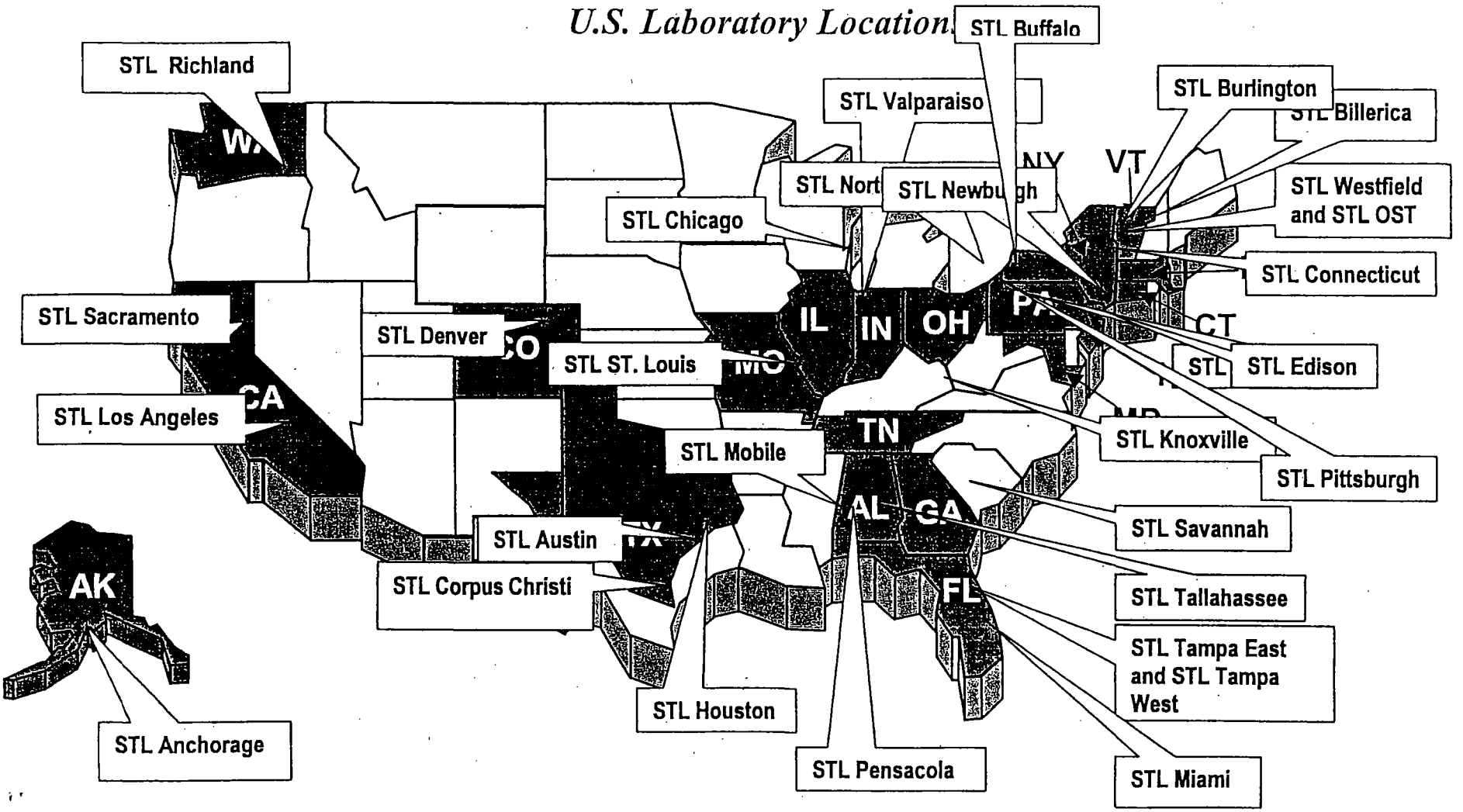
1.2 U.S. LABORATORIES

With 29 laboratory locations and over 1,500 chemists, microbiologists and environmental scientists, STL is well positioned as the leading group of laboratories for environmental testing in the U.S. Through continued investment in facilities, equipment, methods and people, STL can provide a broad range of services to meet clients' varying requirements.

This Statement of Qualifications outlines the services provided by STL's U.S. laboratories. STL's testing capabilities include chemical, physical and biological analyses of a variety of matrices, including aqueous, solid, drinking water, waste, tissue, air and saline/estuarine samples. Specialty capabilities include air toxics testing, mixed waste testing, tissue preparation and analysis, aquatic toxicology and microscopy. STL also operates one of the largest on-site analytical services in the United States via our On-Site Technologies (OST) Division.

The following page illustrates STL's U.S. locations.

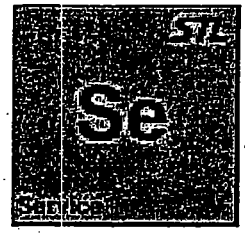
Figure 1A – U.S. Locations



SEVERN TRENT SERVICES

SEVERN TRENT LABORATORIES

SECTION 2



SERVICES

2.1 STANDARD SERVICES

STL understands that scientifically sound, legally defensible analytical data is one of the most critical elements for the success of an environmental project. To ensure a project's data quality objectives are met, STL provides a superior standard of service using the latest technological advances and a commitment to customer service.

STL provides complete cradle-to-grave services, from initial preplanning and consultation, to project management and implementation, to final results and sample disposal.

STL performs analyses under various regulatory programs using both published and laboratory developed and validated test methods. In support of these activities, STL is certified/qualified in 50 states including Washington D.C. and Puerto Rico and participates in several federal programs.

Table 2A – Analytical Protocols and Programs

PROTOCOLS	PROGRAMS
• EPA SW846 → Appendix IX → TCLP/SPLP/MEP • Drinking Water → 40 CFR 141, 143 • Wastewater → 40 CFR 136 → 600, Standard Methods → MCAWW	• Department of Defense (DOD) → U. S. Army → Air Force → Navy → Coast Guard → National Guard and others • Department of Energy (DOE) • Resource Conservation and Recovery Act (RCRA) • Safe Drinking Water Act (SDWA) • Clean Water Act (CWA) • National Pollution Discharge Elimination System (NPDES)
• CLP Statement of Work → TCL/TAL	• Comprehensive Environmental Response, Compensation and Liability Act (CERCLA)/Superfund • Clean Air Act (CAA) • Marine Protection, Research, and Sanctuaries Act – (MPRSA)
• ASTM/NIOSH/EPA → Toxic Organic Compounds in Ambient Air	
• State Specific Protocols → VPH/EPH • USACE Dredged Materials	

2.1.1 Organic Analyses

STL routinely tests for organic compounds using a variety of GC, GC/MS and HPLC test methods as described in Federal Register, EPA SW846 and the CLP Statement of Work. These analyses include volatiles, semivolatiles, pesticides, herbicides, polychlorinated biphenyls (PCBs), dioxins/furans, explosives, total petroleum hydrocarbons (TPH), Appendix IX, TCLP and other regulatory lists.

2.1.2 Inorganic Analyses

For high-speed, accurate metals analyses, STL uses a full array of instrumentation, including both sequential and simultaneous ICP. Low-level detection limits are achieved utilizing Trace-ICP, ICP/MS, Cold Vapor AA and Graphite Furnace AA. STL also provides a full range of wet chemistry analyses for nutrients, BOD, COD and virtually all other general chemistry parameters.

2.2 SPECIALTY SERVICES

In addition to routine analyses, STL has the capability to provide custom testing services for special projects requiring more sophisticated analyses. STL also provides a variety of value-added services that augment the laboratories' analytical capabilities.

Table 2B - Summary of Specialty Services

SPECIALTY SERVICES	
Analytical	**Value-Added**
• Radiochemistry and Mixed Waste Analyses • Microscopy Consulting Services • Geotechnical Analyses • Ambient Air Analyses • Source Emissions Air Analysis • Aquatic Toxicology • Tissue Analyses • Dredged Material Evaluation • CWA Chemical Degradation Analysis • Explosives Analyses (Method 8330) • Pulp & Paper Environmental Analytical Services • Natural Attenuation Byproducts • PCB Congener Analysis • Selective Ion Monitoring • Isotopic Analyses (Methods 1624 and 1625) • AVS/SEM • Alkyl Tins • Incidental PCBs (Method 680) • Low & High Resolution Dioxin / Furans • Specialty Pesticides & Herbicides by GC and HPLC • High Resolution GC / High Resolution MS • Liquid Chromatography/Mass Spectrometry (LC/MS) Liquid Chromatography/Mass Spectrometry/Mass Spectrometry (LC/MS/MS) • Boiler & Industrial Furnace (BIF)	• Mobile Lab Services • Field Sampling • Courier Service • EDD/GIS Capabilities • Consultant Training/Education • National Project Coordination • QAPP Preparation • QAPP Development • Expert Witness Testimony • Hazardous Materials/Health and Safety Training • Technical Support for Pulp & Paper Process Improvements • SF SampleScan • Method Development

2.2.1 Analytical

➢ **Radiochemistry**

STL St. Louis and STL Richland are fully licensed to receive, handle and analyze low-level environmental radioactive samples. Both laboratories provide a broad range of chemical and radionuclide determinations. STL St. Louis, licensed by the Nuclear Regulatory Commission (NRC), analyzes environmental samples, such as soil, water, waste, sediment and vegetation using a wide variety of radiochemical procedures from known regulatory methods (EPA, SW-846) to cutting edge technologies (DOE-EML, Eichrom®). STL Richland is licensed by the State of Washington to handle samples containing radioactive materials in environmental samples including vegetation, milk, wine and air particulates.

➢ **Mixed Waste Analyses**

In addition to STL St. Louis, STL Tampa West and STL Connecticut are also licensed by the NRC to analyze mixed waste samples. All laboratories offer a full array of organic and inorganic analysis.

➢ **Bioassay Monitoring**

Bioassay analysis identifies and assesses the degree, if any, of internal radiation exposure. STL Richland offers a full range of bioassay analyses for radioactive and stable toxic elements and compounds in urine, feces, hair, tissue, blood, bone and other biological materials.

➢ **Microscopy Consulting Services**

STL Billerica offers a variety of microscopy consulting services including Scanning Electron Microscopy (SEM), Energy Dispersive X-Ray (EDX), Robinson Back Scatter Electron Detector, Transmission Electron Microscopy (TEM) and Optical Microscopy. These services can support a variety of industries including manufacturing, R&D, environmental, biomedical materials, engineering, electronics, forensics and graphic arts. Applications for this service include coating and thickness measurement, particle counting, printed wiring board manufacturing, electroplating, metal fabrication and non-destructive chemical analysis.

➢ **Geotechnical Testing**

To supplement geological studies, STL Burlington maintains a soil characterization laboratory. Laboratory technicians follow ASTM methods to define soil permeability, particle size, Atterberg limits, moisture, in place density, soils classification, specific gravity and hydraulic conductivity.

➢ **Air Analyses**

STL Austin, STL Burlington, STL Pensacola, STL Houston, STL Knoxville, STL Los Angeles, STL Miami, STL Sacramento and STL Savannah provide a variety of air services including the analysis of ambient, landfill and indoor air. Analyses include volatile and semivolatile compounds, pesticides/PCBs, polynuclear aromatic hydrocarbons and fixed gases. STL can also support air monitoring programs through sampling, continuous monitoring and permit consulting services.

➢ **Source Testing**

STL Austin, STL Sacramento and STL Knoxville laboratories offer analytical services for stack and process samples for various parameters including dioxin/furans, PAH, PCBs, metals, SVOC and

particulate in support of municipal waste incinerators, pulp and paper mills, sludge incinerators and chemical disposal incinerators.

➢ **Aquatic Toxicology**

STL Westfield offers both freshwater and saltwater toxicity testing. This work is often completed pursuant to the requirements of the NPDES DMR program and stormwater monitoring assays. The protocols currently available from STL Westfield include 48-hour LC50 determinations, 7-day Modified Acute/ Chronic assays, NPDES Stormwater assays, Pass/Fail Acute screenings and Toxicity Identification (TIE) and Toxicity Reduction (TRE) Evaluations.

➢ **Tissue Analyses**

STL Sacramento, STL Knoxville, STL Baltimore, STL Burlington, STL Savannah, STL Mobile, STL Tallahassee and STL Tampa West and STL Tampa East are recognized as leaders in the industry with respect to analysis of biological and vegetative tissues for a host of environmental parameters. At STL Baltimore, biological and vegetative tissues are prepared using American Society for Agronomy (ASA) and Association of Official Analytical Chemists (AOAC) methodologies, followed by routine analysis or by non-routine reference methods. At all laboratories, tissue sample analyses are generally tailored to project specific requirements, and require some development to ensure that target detection limits can be achieved with reduced sample sizes. Biological tissue analyses have been performed on aquatic, marine, terrestrial, and benthic species in support of site investigations, risk assessment, and permitting requirements on both full-body and specific organs for bioaccummulation.

➢ **Dredged Material Evaluation**

STL Baltimore, STL Sacramento, STL Knoxville, STL Savannah, STL Mobile, STL Tallahassee and STL Tampa can support dredged material evaluation activities with analysis of sediment, eluate, elutriate, and tissue matrices for varied constituents of concern. Methodologies are performed in strict accordance with the regulatory requirements of the *Green Book, Inland Testing Manual, Management and Regulation of Dredging Activities in New Jersey's Tidal Waters*, and EPA's *Regional Implementation Manuals*. Specialty analyses have been developed to support such activities including STL's proprietary 'Co-planar PCBs by High Resolution Gas Chromatograph, High Resolution Mass Spectroscopy methodology conducted by STL Sacramento and STL Knoxville, Dioxin/Furans, PCB Congeners, AVS/SEM, and a chelation extraction procedure for metals determination. STL Burlington also has the capabilities to support dredged material evaluation activities for select analyses.

➢ **CWM Chemical Degradation Analysis**

STL Baltimore, STL Sacramento, STL Denver and STL Knoxville offer analysis of Chemical Warfare Related Compounds. Compounds include environmental degradates of surety agents as well as other related chemicals. STL offer analytical services for the chemical degradation products water, soil/sediments, and tissue matrices. STL is fully capable of analysis for these compounds using the traditional USATHAMA methods. STL Sacramento pioneered the adaptation of Liquid Chromatography / Mass Spectrometry (LC/MS) and Liquid Chromatography/Mass Spectrometry (LC/MS) Liquid Chromatography/Mass Spectrometry/Mass Spectrometry (LC/MS/MS) methods that overcome some of the limitations of the traditional methods. STL can also provide analyses for the surety agents through our established partnership with an ERCD-certified laboratory.

➢ **Explosive Analysis**
STL Baltimore, STL Burlington, STL Chicago, STL Denver, STL Knoxville, STL Sacramento, STL St. Louis and STL Tallahassee can provide explosive analysis by Method 8330. This analysis can be performed on a variety of matrices including soils, waters and plant and animal tissues. STL Sacramento and STL Denver also uses Liquid Chromatography/Mass Spectrometry (LC/MS) Liquid Chromatography/Mass Spectrometry/Mass Spectrometry (LC/MS/MS).

➢ **Pulp & Paper Environmental Analytical Services**
The Cluster Rule and Hazardous Air Pollutants (HAPs) monitoring requirements for the Pulp and Paper Industry can be provided through the STL Savannah and STL Mobile facilities. These facilities offer a comprehensive array of TAPPI, NCASI, EPA and other related tests to meet pulp and paper mill compliance testing needs which include the analysis of AOX, Chloroform, Chlorinated Phenolics, Methanol, Acetaldehyde, Methyl Ethyl Ketone and Propionaldehyde. STL Knoxville and STL Sacramento also provides dioxin/furan analyses on various matrices for routine and process control samples.

➢ **Natural Attenuation Byproducts (Intrinsic Bioremediation Evaluation)**
STL Savannah offers a wide array of analyses used to model intrinsic bioremediation. Specialty tests include chlorocatechols, dissolved gases, nutrients, demand and other traditional wet chemistry parameters.

➢ **Dioxin / Furan Analysis**
STL Knoxville and STL Sacramento offer dioxin/furan analysis on a wide variety of sample matrices including fish tissue, sludge, effluents, ambient air, stack emissions, pulp and paper products, soil and water. Analysis is conducted using state-of-the-art equipment; Methods used include EPA 8280, EPA 1613A, EPA SW-846 8290 and EPA-CLP DFLM01.0 for PCDD/PCDF. STL Savannah provides dioxin analysis using EPA Method 8280.

➢ **High Resolution Gas Chromatography High Resolution Mass Spectroscopy**
STL Knoxville and STL Sacramento have a long history of successful analysis of persistent organic pollutants in a wide variety of matrices for volatiles, semivolatiles, dioxins/furans, PAH and the use of STL's proprietary method for Co-planar PCBs

➢ **Boiler & Industrial Furnace Testing**
STL Austin can provide analyses in support of Boiler and Industrial Furnace Testing (40 CFR Part 266) (BIF). Tests include measurements of volatiles, semivolatiles, metals, anions and hexavalent chromium.

2.2.2 Value-Added

➢ **On-Site Technologies (OST) Division**
As one of the largest on-site analytical services divisions in the United States, STL's OST Division can provide a variety of on-site services.

Mobile Laboratory Services

STL's OST Division operates six mobile laboratories including 28' fifth wheel trailers and 45' box trailers. These laboratories are equipped to provide for on-site analysis of water and soil samples for volatile organics, PCBs, chlorinated pesticides and herbicides, total petroleum hydrocarbons, polyaromatic hydrocarbons and metals. Soil gas surveys for volatile organic compounds are also available. All of STL's mobile laboratories are designed to provide rapid, high quality and cost-effective data on location.

Contract/Operation Laboratories

The OST Division of STL provides for the staffing and operation of laboratories located at various contract/operation type projects including long-term remediation projects or site investigations. STL utilizes its experience with environmental analyses to provide for the rapid analysis of a variety of organic and inorganic constituents.

Sample Acquisition/Field Services

STL has several field sampling groups, including the OST Division, that provide a full range of sampling services for soil, air, groundwater, surface water, wastewater and other waste streams. These groups have successfully managed UST, NPDES, RCRA and state ISRA programs requiring field sampling and reporting in accordance with state and federal agencies. They have compiled field and analytical data and reports consisting of contour maps, photo-documentation, conclusions and recommendations.

Innovative In Situ Analyses

STL is committed to providing our clients with the most up-to-date technologies available for obtaining analytical data in the field. The OST Division is constantly reviewing innovative technologies which will allow STL to provide high quality and timely data at the point of sample collection.

➢ Courier Service

STL offers sample pick-up for local clients. This service is designed for customer convenience and may have a small fee dependent upon the location of sample pick-up. STL's couriers are trained in sample handling and transportation protocols.

➢ EDD/GIS Capabilities

In addition to producing standard electronic deliverables, some STL facilities have formed an alliance with GIS/Key and EQUIS, two companies that have developed GIS software packages for managing environmental data. Using GIS/Key and EQUIS, these STL facilities can produce the necessary files for electronic import of chemistry data and transmit data directly into a client database.

➢ Consultant Training/Education

STL offers training programs on topics such as sample custody, laboratory quality assurance/quality control, method selection, state specific method variations and regulatory overview. STL also provides customized presentations based on client requests.

➢ **National Project Coordination**
STL provides a national point of contact to oversee the administration of multiple-site projects that utilize several of STL's facilities. This contact works with each laboratory communicating customer expectations, resolving issues and implementing proactive logistical solutions.

➢ **Quality Assurance Project Plan (QAPP) Preparation**
STL personnel can provide assistance in writing QAPPs for a variety of projects, ranging from one time sampling events to long term remedial investigations.

➢ **Method Development**
STL can develop new, or modify existing, analytical methodologies for projects where existing methods do not meet project objectives. All method development goes through rigorous method validation to ensure accurate and complete data.

➢ **Hazardous Materials/Health and Safety Training**
STL Miami offers four different Hazardous Materials/Health and Safety Training courses include 40 Hour HAZMAT/Health and Safety, 24 Hour Limited Exposure/Site Support, 8 Hour Hazardous Materials Supervisor/Management and 8 Hour Annual Refresher. STL Precision's environmental health and safety experts are also available to discuss individual requirements and design customized programs that address client's needs.

➢ **Technical Support for Pulp & Paper Process Improvements**
In addition to environmental analytical services, STL Savannah and STL Mobile facilities offer the pulp & paper industry technical support such as feasibility analysis for engineering plant modifications, retention time and waste loading studies, capacity for wastewater treatment plant loading and chlorine dioxide generator optimization.

➢ **STL SampleScan**
STL Denver offers an automated barcode sampling system for the accurate and unique identification of each sample container. This automation increases sampling speed and improves accuracy. This system allows for sample information to be downloaded into the fixed laboratory's laboratory information system for complete and accurate representation of samples delivered.

2.3 DATA MANAGEMENT

Through advanced information technology and electronic data exchange, STL is constantly striving to develop faster and more efficient methods of information gathering and distribution. STL knows there are no short cuts to producing consistently reliable results, however investments in information technology enable STL to quickly and efficiently gather, process and deliver sample results, saving valuable time and money for the client.

2.3.1 Data Reporting

STL can provide various types of data reporting based upon a project's needs. STL facilities can produce data packages as simple as an analytical report with results only, to reports as complex as CLP-like data

packages that include a narrative, analytical results, and supportive documentation including all raw data and chain of custody documentation.

STL's facilities also have experience producing reports for the Navy (NFESC), Air Force (AFCEE), Army Corps of Engineers (USACE), New Jersey Department of Environmental Protection (NJDEP) and New York State Department of Environmental Conservation (NYSDEC).

2.3.2 Electronic Deliverables

In addition to hard copy reports, STL can provide data electronically on diskette, CD-ROM, via e-mail or by modem. STL can produce a wide variety of file formats, compatible with all major software programs such as Lotus, Quattro Pro, Excel, Paradox, dBase, Oracle, Access, Word and Word Perfect. Utilizing the Laboratory Information Management System and subsystems, STL is able to produce deliverables with a broad range of data elements in many customized formats. STL has successfully delivered EPA CLP Agency Standard formats and also provides data to AFCEE in ERPIMS and USAEC in IRDMIS.

2.4 CLIENT SERVICES

STL's client services are built on a foundation consistent with the principles of Total Quality Management. Customer focus, support, continuous improvement, and measurement are the defining characteristics of STL's commitment to customer service.

At STL, every customer service representative is committed to understanding and meeting customer expectations. This proactive approach allows STL's personnel to provide solutions to current requirements while anticipating future needs and expectations. From the smallest detail to understanding the 'Big Picture', STL's customer service representatives diligently strive, meet and exceed customer expectations.

2.4.1 Project Management

STL uses a project management system to plan, coordinate, integrate and monitor project activities. Project management personnel work with the operations staff and clients to schedule projects, track progress, and review and produce final reports.

At STL each client is assigned a project manager to oversee the successful completion of their project from the definition stage to the final submittal of data. STL's project managers have extensive experience in the environmental field and are well equipped to handle both business and technical matters.

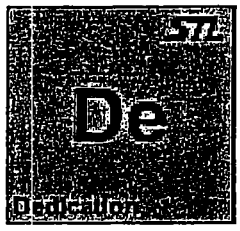
Prior to the initiation of all large projects, STL establishes a project team of qualified laboratory professionals. Once the project team has been established, a kick-off meeting is held to ensure that all team members have an understanding of the technical and administrative requirements of the project. Sample schedules, turnaround time and reporting requirements are communicated and delegation of responsibilities is established. If necessary, laboratory resources are shifted to ensure that all project requirements are met.

STL strongly encourages our clients to visit the laboratory and hold formal or informal sessions with employees in order to effectively communicate their needs on an ongoing basis.

SEVERN TRENT SERVICES

SEVERN TRENT LABORATORIES

SECTION 3



RESOURCES

3.1 FACILITIES

STL's facilities are designed for efficient, automated high-quality operations. Super minicomputers and PC networks are used for sample tracking, work scheduling, status reporting and electronic data transfer to clients.

All STL facilities are equipped with structural safety features. Each employee is familiar with the location, use, and capabilities of general and specialized safety features associated with their workplace. STL also provides and requires the use of certain items of protective equipment including safety glasses, protective clothing, gloves, respirators, etc.

Because of the sensitivity of the work STL performs, access to all STL facilities is controlled through various security systems including locks, passwords, electronic access cards and manned reception areas.

Table 3A - Laboratory Square Footage

Facility	Square Footage
STL Sacramento	66,000
STL Savannah	55,000
STL Denver	54,000
STL North Canton	53,000
STL Chicago	51,000
STL Austin	43,000
STL Burlington	36,000
STL Richland	33,000
STL Buffalo	32,000
STL St. Louis	30,800
STL Edison	30,000
STL Pittsburgh	30,000
STL Knoxville	29,400
STL Houston	28,000
STL Los Angeles	27,000
STL Tallahassee	22,000
STL Anchorage	20,000
STL Pensacola	18,000
STL Connecticut	17,000
STL Baltimore	17,000
STL Mobile	14,000
STL Tampa West	12,000
STL Corpus Christi	12,000
STL Tampa East	11,200
STL Billerica	10,000
STL Westfield	10,000
STL Miami	9,000
STL Newburgh	8,000
STL Valparaiso	7,000
TOTAL	757,400

3.2 INSTRUMENTATION

STL has made a corporate commitment to routinely update and automate instrumentation. STL's facilities contain instrumentation and equipment for analyzing water, wastewater, solid waste, soil, sludge, tissue and air samples.

STL employs a system of preventative maintenance in order to ensure system up time, minimize corrective maintenance costs and ensure data validity. All routine maintenance is performed as recommended by the manufacturer and may be performed by an analyst, instrument specialist or outside technician.

Table 3B - Equipment List Summary

Number of Units	Type of Instrumentation
401	Gas Chromatographs (GC)
240	Gas Chromatographs/Mass Spectrometers (GC/MS)
197	Alpha Spectrometers
81	Atomic Absorption Spectrophotometer (AA)
79	Gas Proportional Counter
70	Inductively Coupled Argon Plasma Emission Spectrophotometers (ICP)
40	High Performance Liquid Chromatographs (HPLC)
34	Infrared Spectrophotometers (IR)
34	Cold Vapor Atomic Absorption Spectrophotometer (CVAA)
33	Ion Chromatograph (IC)
30	Wet Chemistry Autoanalyzer
29	UV-Visible Spectrophotometer
27	Total Organic Carbon Analyzer (TOC)
24	Total Organic Halogen Analyzer (TOX)
8	Gamma Spectrometer
7	Liquid Scintillation Detector
6	High Resolution Gas Chromatographs / Low Resolution Mass Spectrophotometers (HRGC/LRMS)
5	High Resolution Gas Chromatographs / High Resolution Mass Spectrophotometers (HRGC/HRMS)
4	Inductively Coupled Argon Plasma Emission Spectrophotometers – Mass Spectrometers (ICP-MS)
4	Kinetic Phosphorescence Analyzer
2	Transmission Electron Microscope (TEM)
2	Liquid Chromatography Mass Spectrophotometers (LCMS)
1	Fourier Transform Infrared Spectrophotometer (FTIR)
1	Scanning Electron Microscope (SEM)

3.2.1 Capacity

STL monitors capacity throughout its group of laboratories on a weekly basis. This monitoring allows STL to best utilize the resources available and schedule projects accordingly to ensure that client deadlines are met.

3.3 PERSONNEL

STL's staff of over 2000 professionals includes analytical chemists, microbiologists, quality assurance specialists, computer systems analysts, environmental technicians, client services staff, project managers and field personnel. STL is proud of its highly qualified and professional staff. Their development is valued as the key to success.

STL's Corporate structure is outlined in STL's Quality Management Plan (QMP), referenced in Section 4. The QMP describes Corporate management's role and responsibilities. Members of the corporate staff set the quality standards by which STL's business operations and personnel strive to achieve. Description of management's capabilities and experience is provided.

Each STL facility is under the supervision of a Laboratory Director who is responsible for the day to day operations of the laboratory facility. In addition, each facility has a Quality Assurance Manager who is responsible for overseeing the QA program of the laboratory. STL's Laboratory Directors and Quality Assurance Managers have an average of over 16 years of experience in the environmental field.

Figure 3A – Corporate Management

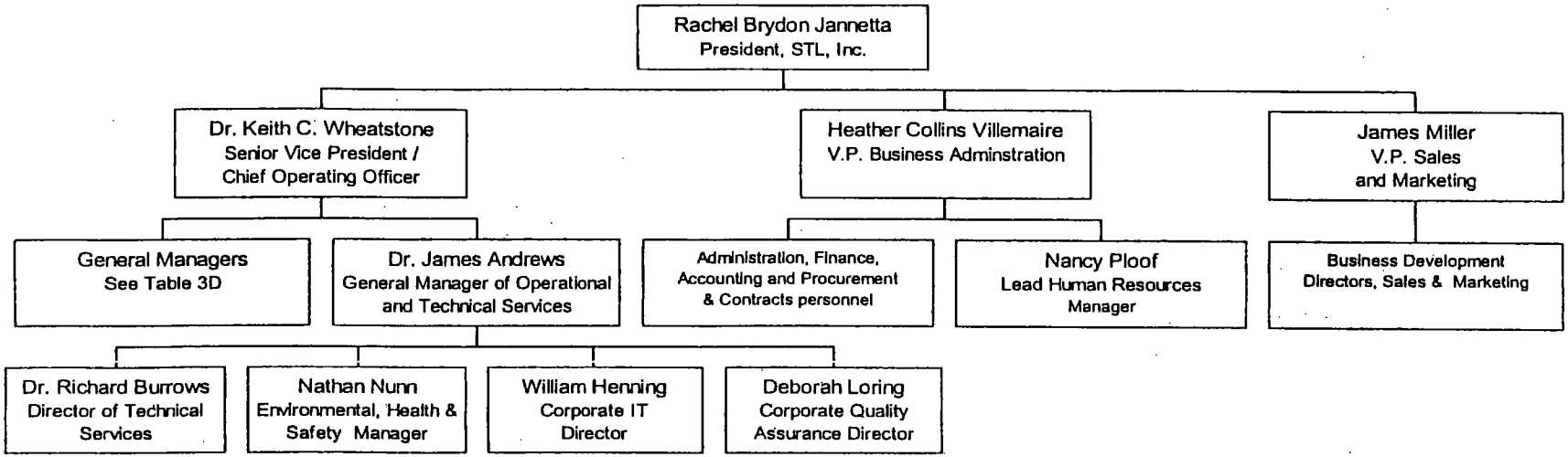


Table 3C – Corporate Management

Name	Title	Degree	Experience
Rachel Brydon Jannetta	President	Fellow of the Chartered Association of Certified Accountants (FCCA)	Ms. Jannetta has been President of STL for 7 years, responsible for the development and implementation of STL's US acquisition and growth strategy. Ms. Jannetta's business previous experience dates back to 1976 - 10 years in general management, 6 years in the financial sector.
Dr. Keith C. Wheatstone	Senior Vice President / Chief Operating Officer	Ph.D. Analytical Chemistry	Dr. Wheatstone has 38 years of environmental laboratory experience, 26 years of which has been with STL. Dr. Wheatstone has held various management positions including Director of Operations for STL-UK. Dr. Wheatstone has worked for STL in UK, India, Puerto Rico, Slovakia, Italy and Germany.
Heather Collins Villemaire	V.P. Business Administration	B. S. Business Administration	Ms. Villemaire has 13 years experience in Business Administration with nine years in the environmental testing industry. Her previous experience includes various management and officer positions including Director of Business Administration, Controller and Director.

Name	Title	Degree	Experience
James Miller	V.P. Sales & Marketing	B. S. Chemical Engineering / Journalism	Mr. Miller has over 14 years experience in the environmental laboratory industry. He was an officer of Recra Environmental where he worked for eight years. In addition, Mr. Miller worked at a major chemical company for six years.
Dr. James Andrews	General Manager of Operational and Technical Services	Ph.D. Nutritional Biochemistry	Dr. Andrews has over 30 years of experience; beginning Savannah Laboratories in 1975. He participated in research and method development with EPA and has worked with NELAC. Dr. Andrews is a member of a National Academy of Sciences subcommittee and affiliated with the ACIL.
Deborah Loring	Corporate QA Director	B. S. Chemistry	Ms. Loring has a total of 16 years experience in the environmental laboratory field that includes bench chemist, laboratory manager, regional QA manager and laboratory director.
Nathan Nunn	Environmental, Health & Safety Manager	B. S. Chemistry	A member of the American Society of Safety Engineers, Mr. Nunn has over 15 years of experience designing, implementing and managing programs to comply with Federal, State and Local regulations and employee training.
William Henning	Corporate IT Director	MBA; B. A. Sociology	Mr. Henning has worked in Information Technologies for over 22 years, 19 in the pharmaceutical industry.
Dr. Richard Burrows	Director of Technical Services	Ph.D. Analytical Chemistry	Dr. Burrows has over 18 years of experience in analytical chemistry in academic and commercial settings. He specializes in chromatography and mass spectrometry. Dr. Burrows has held management positions at a number of labs specifically Senior Scientist and Directory of Technology.
Nancy Ploof	Lead Human Resources Manager	Degree in progress	Ms. Ploof has over 3 years experience as Human Resource Manager working directly with local HRM and Coordinators. Past experience has included all aspects of HR, payroll processing, staff recruitment and Affirmative Action Officer. Ms. Ploof has a total of 11 years of Accounting experience.

Table 3D – General Managers

Name	Location Responsibility	Degree	Experience
Thomas Stephens	Mobile, Pensacola, Tallahassee, Tampa West	B. S. Chemistry	Mr. Stephens has over 31 years experience in environmental laboratory business, beginning with 15 years as chemist for Florida agencies, and 15 years as Lab Director and VP of Savannah Laboratories.

Name	Location Responsibility	Degree	Experience
Dr. Charlie Carter	Austin, Corpus Christi, Houston, Richland, St. Louis	Ph.D. Environmental Chemistry	Dr. Carter has over 20 years experience in the environmental testing industry. He is currently a director of the ACIL environmental section. Academic background includes studies in environmental chemistry and analytical chemistry and philosophy.
Jeff Graham	Knoxville, Tampa East, Miami	B. S. Chemistry	Mr. Graham has 16 years of experience in the environmental laboratory field.
Roger Freize	Anchorage, Los Angeles, Sacramento	MBA; B. S. Petroleum Engineering	Mr. Freize has over 15 years experience in the environmental laboratory field. Experience includes Lab Supervisor, Sales, Systems Manager, Laboratory Manager and General Manager.
Mark Nebiolo	Baltimore, North Canton, Pittsburgh	M. S. Biology	Mr. Nebiolo has more than 20 years experience in the environmental testing industry. He is experienced in all aspects of lab management operations and business development.
Ron Bayer	Billerica, Burlington, Connecticut, Newburgh, On-Site Laboratories, Westfield	M. S. Environmental Science	Mr. Bayer was the former owner and founder (in 1974) of Envirotest Labs in Newburgh, NY. He has 26 years of experience in the environmental testing field.
Robert Wyeth	Buffalo, Denver	M. S. Analytical Chemistry	Mr. Wyeth has over 30 years experience in the commercial environmental testing industry. He is an active participant in ACIL, WEF, NELAC and other related industry activities.
Daniel Santaniello	Edison	B. S. Electrical Engineering	Mr. Santaniello has over seven years of experience in the laboratory services business specializing in Information Systems and Operations. He was Corporate MIS Director for one and one half years.
Mike Healy	Chicago, Valpariaso	B. S. Environmental Biology	Mr. Healy has over 17 years experience in the environmental laboratory business that includes bench chemistry, field sampling, project management and laboratory management.
Dr. Jack Tuschall	Savannah	Ph.D. Environmental Engineering Science	Dr. Tuschall has extensive experience in managing full-service analytical laboratories, analytical method development; trace organic, inorganic and mixed-waste analyses; design and implementation of quality assurance programs.

Table 3 E - Key Laboratory Personnel

Name	Title	Laboratory	Degree	Years of Exp.

Name	Title	Laboratory	Degree	Years of Exp.
Jesse Smith	Laboratory Director	STL Mobile	B.S. Science	28
Charles Newton	QA Manager	STL Mobile	B.S. Biology	8
Jeff Curran	Laboratory Director	STL Connecticut	M.S. Chemistry	21
Marsha Culik	QA Manager	STL Connecticut	A.A.S. Applied Science	17
Susan Rembert	Laboratory Director	STL Pensacola	B.S. Geology	13
Kelly Hered	QA Manager	STL Pensacola	B.S. Chemistry	13
Michael Spitzer	Laboratory Director	STL Miami	B.S. Chemistry	16
Theresa Giglio	QA Manager	STL Miami	B.S. Biology	12
Janet Pruitt	Laboratory Director	STL Tallahassee	M.P.H. Environmental Health	34
Steven Worrell	QA Manager	STL Tallahassee	B.A. Interdisciplinary Natural Science	8
Andre Rachmaninoff	Laboratory Director	STL Tampa West	B.S. Biology	21
Kathleen Raftery	QA Manager	STL Tampa West	QA/QC-Food, Pharmaceutical and Environmental	18
Dr. Jack Tuschall	Laboratory Director	STL Savannah	Ph.D. Environmental Engineering Science	28
Kirstin McCracken	QA Manager	STL Savannah	B.A. Geography	7
Mike Healy	Laboratory Director	STL Chicago	B.S. Environmental Biology	17
Raymond Frederici	QA Manager	STL Chicago	M.B.A; B.S. in Environmental Biology	18
John O'Donnell	Acting Lab Director	STL Baltimore	Science Course Work & Work Experience	18
Mimi Uhlfelder	QA Manager	STL Baltimore	M.S. Chemical Oceanography	31
Dr. Michael Wheeler	Laboratory Director	STL Billerica and STL Westfield	Ph.D. Inorganic Chemistry	13
Peter Bowser	QA Manager	STL Billerica and STL Westfield	M.S. Environmental Resource Management	7
Michael Urban	Laboratory Director	STL Edison	B.S. Chemistry	24

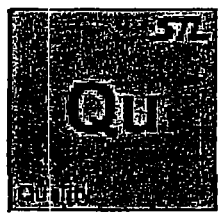
Name	Title	Laboratory	Degree	Years of Exp.
Madhuri Dave	QA Manager	STL Edison	B. S. Microbiology / Chemistry	16
Susan Tinsmith	Laboratory Director	STL Buffalo	B.S. Chemistry	11
Chuck Huber	QA Manager	STL Buffalo	B. A. Chemistry	6
Lou Cercone	Laboratory Director	STL Newburgh	B.A. Biology	22
Patricia Chany	QA Manager	STL Newburgh	B.S. Environmental Chemistry	19
Chris Ouellette	Laboratory Director	STL Burlington	B.S. Biology	9
Kim Watson	QA Manager	STL Burlington	B.S. Environmental Engineering	18
Peter Law	Laboratory Director	STL On-Site Technologies Division	B.S. Environmental Sciences	18
Emanuel Hignutt	Laboratory Director	STL Anchorage	B. A. Chemistry	15
Dr. Rolland Grabbe	QA Manager	STL Anchorage	Ph.D, Chemistry	20
Sharon Mertens	Laboratory Director	STL Austin	B. S. Medical Technology	21
Alice Wusterhausen-Colt	QA Manager	STL Austin	B.S. Zoology	25
Chip Meador	Laboratory Director	STL Corpus Christi	M. S. Botany / Ecology	19
Olga McDonald	QA Manager	STL Corpus Christi	B. S. Medical Technology	9
Tim O'Shields	Laboratory Director	STL Denver	B. S. Chemistry	20
Larry Penfold	QA Manager	STL Denver	Chemistry Course Work & Work Experience	25
Norm Flynn	Laboratory Director	STL Houston	M. S. Animal Nutrition	20
LaDonna Kibler	QA Manager	STL Houston	B. S. Biology & Chemistry	15
Tom Yoder	Laboratory Director	STL Knoxville	B. S. Business Administration	14
Dr. Chris Rigell	QA Manager	STL Knoxville	Ph.D. Biochemistry	20
Elizabeth Winger	Laboratory Director	STL Los Angeles	B. S. Biological Sciences	8

Name	Title	Laboratory	Degree	Years of Exp.
Sevdâ Aleckson	QA Manager	STL Los Angeles	B. A. Chemistry	19
Christopher Oprandi	Laboratory Director	STL North Canton	B. S. Chemistry	12
Opal Davis-Johnson	QA Manager	STL North Canton	B. A. Chemistry	14
Rusty Vicinie	Laboratory Director	STL Pittsburgh	B. S. Chemistry & Biology	13
Patrick Conlon	QA Manager	STL Pittsburgh	MBA; B. S. Chemistry	18
Kevin Bull	Laboratory Director	STL Richland	M. S. Chemistry	19
Jodie Carnes	QA Manager	STL Richland	B. S. Bacteriology	13
Eric Redman	Laboratory Director	STL Sacramento	M. S. Chemical Physics	20
Pamela Schemer	QA Manager	STL Sacramento	B. S. Chemistry	10
Bill Decklmann	Laboratory Director	STL St. Louis	B. S. Biology	13
Brian Crandall	QA Manager	STL St. Louis	M. S. Health Physics	16
Rich Detar	Laboratory Director	STL Tampa East	B. S. Chemistry	12
Dr. Shibu Paul	QA Manager	STL Tampa East	MBA, Ph.D. Environmental Chemistry	11
Les Arnold	Laboratory Director	STL Valparaiso	Environmental Technologies	21
Linda Moore	QA Manager	STL Valparaiso	B. A. Chemistry	14

SEVERN TRENT SERVICES

SEVERN TRENT LABORATORIES

SECTION 4



QUALITY ASSURANCE

4.1 QUALITY ASSURANCE POLICY

It is STL's policy to:

- provide high quality, consistent, and objective environmental testing services that meet all federal, state, and municipal regulatory requirements.
- generate data that are scientifically sound, legally defensible, meet project objectives, and are appropriate for their intended use.
- provide STL clients with the highest level of professionalism and the best service practices in the industry.
- build continuous improvement mechanisms into all laboratory, administrative, and managerial activities.
- maintain a working environment that fosters open communication with both clients and staff.

4.1.1. Objectives of STL Quality System

The goal of the STL Quality System is to ensure that business operations are conducted with the highest standards of professionalism in the industry.

To achieve this goal, it is necessary to provide STL clients with not only scientifically sound, well documented, and regulatory compliant data, but also to provide the highest quality service experience available in the industry. STL's Quality System is designed to provide a framework for continuous improvement within the organization, minimize systematic error, and to encourage constructive, documented problem solving.

4.1.2 Management Commitment to Quality Assurance

STL management is committed to providing the highest quality data and the best overall service in the environmental testing industry. To ensure that data produced and reported by STL meet the requirements of its clients and comply with the letter and spirit of municipal, state and federal regulations, STL maintains a Quality System that is clear, effective, well communicated and supported at all levels in the company.

The elements that comprise STL's Quality System are outlined in detail in the Quality Management Plan. This document can be obtained by contacting any STL facility.

4.1.3 Proficiency Testing

STL analyzes Proficiency Test (PT) samples as required for accreditation and as outlined in the National Environmental Laboratory Accreditation Conference (NELAC). Each STL facility participates in the PT program semi-annually for each area of testing and matrix (e.g. organics, inorganics, microscopy, radiological, microbiological; aqueous and drinking water) for which it is certified. In addition to the PT program required for NELAC accreditation, STL facilities participate in a number of additional PT programs such as the EPA Contract Laboratory Protocol (CLP) Performance Evaluation program and the Navy and Army Corps of Engineers Laboratory Assessment program.

4.1.4 Double Blind Performance Evaluation

Each STL facility also participates in a double blind performance program annually, which is administered by the Corporate QA Manager. An external vendor is contracted to submit double blind samples to each STL facility. Both the level of customer service and the accuracy of the test results are assessed objectively by the external contractor, who provides a detailed report to the Corporate QA Director and each of the STL facilities. This is administered as a double blind program in order to assess all facets of STL operations.

4.1.5 Client Confidentiality and Proprietary Rights

Data and sample materials provided by the client or at the client's request, and the results obtained by STL, are held in confidence subject to any disclosure required by law or legal process. STL's reports, and the data and information provided therein, are for the exclusive use and benefit of the client, and are not released to a third party without written consent from the client.

4.1.6 Record Retention and Archival

STL has developed a formal record retention policy in its Corporate Quality Management Plan that outlines the period of time various record types must be archived. Archives are indexed such that records are accessible on either a project or temporal basis. Archives are protected against fire, theft, loss deterioration and vermin. Electronic records are protected from deterioration caused by magnetic fields and/or electronic deterioration. Access to archives is controlled and documented.

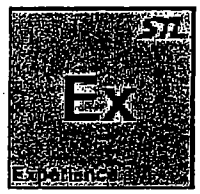
4.2 CERTIFICATIONS

STL is certified/qualified in 50 states and several federal programs. It is important to note that some states only certify in-state labs, but accept results from out-of-state labs as long as they are certified in the state in which they are located and pass WP/WS studies. A listing of all of STL's certifications can be found in Appendix B.

SEVERN TRENT SERVICES

SEVERN TRENT LABORATORIES

SECTION 5



PROJECT EXPERIENCE

5.1 PROJECT DESCRIPTIONS

Although their trading names may have changed, the underlying strength of STL's laboratories, personnel and commitment, has remained the same. STL's laboratories have vast experience with all matrices, methods, protocols and environmental programs working on behalf of industry, commerce and government.

5.1.1 Federal/State/Local Agencies

Client	Project Type	Description
USEPA	Contract Laboratory Program	Several STL facilities were past participants in the USEPA Contract Laboratory Program for both organic and inorganic Statements of Work.
Engineering Firm	Total Environmental Restoration Contract	STL is providing environmental analyses in support of several USACE Total Environmental Restoration Contract (TERC) Programs including Omaha, Kansas, Savannah and New England. Analytical services are being performed on sites in Stratford, CT, Norwood, MA, Red Stone Arsenal, Joliet Army Ammunition Plant and Silresim Superfund Site and include the performance of pest/PCBs, semivolatiles, volatiles, trace explosives and CWM Degradate Agents and wet chemistry methods.
Large Municipality	Permit Monitoring	STL supports a municipality's 301(h) permit monitoring efforts involving the analysis of marine sediments and biota for volatiles, semivolatiles, OP Pesticides/PCBs, trace metals and cyanide. Methods include vacuum distillation for the preparation of samples for volatiles and adaptations of Methods 1624 and 1625 for the analysis of volatiles and semivolatiles by isotope dilution. Additional analytical services include BOD, COD, volatile solids, dissolved sulfide and oil and grease on marine sediments.
Environmental Engineering Firm	NYSDEC – Analytical Services Protocols	STL analyzed waters, soils, leachates, sediments and tars for the entire list of EPA target analytes in accordance with NYSDEC ASP protocols and reporting requirements. This project required close communication with the NYSDEC to establish appropriate clean-up methods for sample extracts to prevent sample dilution due to matrix interferences.
Municipal Airport Authority	Stormwater Monitoring	Beginning in 1993, the EPA mandated a large stormwater monitoring program to determine the source of contamination of a major Florida river. The sampling events take place on both a monthly basis and as-needed basis, utilizing a full range of stormwater parameters.
Airport Authority	Groundwater and Soil Remediation	A large airport was under a mandate to assess and begin remediation of a complete airport facility. Because of the mass amounts of samples, and the limited time frames allowed to sample, all groundwater samples needed to be analyzed within two calendar days and all soils needed to be analyzed within three calendar days. STL was able to supply results consistently utilizing their seven day a week, 16-hour day work schedule. The main constituents analyzed on this project were volatiles, semivolatiles and metals.
United States	Various	STL currently holds a contract to support cooperative projects with the Air Force, Army, Navy, National

Client	Project Type	Description
Geological Survey (USGS) Cooperative Projects		Guard, EPA, BLM, other federal state and local agencies as well as research projects within USGS. Projects include hazardous waste site investigations under RCRA and CERCLA; wastewater and stormwater projects under CWA; drinking water projects under SDWA; ocean dredging and disposal and various research projects. To date, well over 20,000 surface water, groundwater, drinking water, soil, sediment, waste, air and biota samples have been analyzed for USGS. Analyses include VOC, SVOC, pesticides, herbicides, metals, explosives, dioxins, PCB Congeners, PAH, air toxics, radiochemistry and wet chemistry.
NASA	NPDES, RCRA	Performing according to NASA statement of work, STL has performed various on-going projects at sites at the Kennedy Space Center in Florida since 1997.
Consulting Firm	RI at Alabama Arsenal; NPL Sites	Several STL labs provide support of on-going investigations at numerous arsenal sites, some of which were added to the NPL by the EPA in 1994. In total, the labs analyze samples from more than 90 sites. Some of these sites were known chemical warfare agent sites. Samples are analyzed using SW-846 methods for a wide variety of parameters including: VOC, SVOC, Pesticides/PCBs, explosives, Metals, TCLP, GRO, DRO, TPHC, Thiodiglycol, White Phosphorous and wet chemistry parameters. Full Deliverable package includes EDD.
Environmental Consulting Firm	Site Cleanup of Major Chemical Agent Disposal Facility	This high-profile and politically sensitive project, under the intense scrutiny by the ACOE, USEPA and the state of Utah, was awarded to STL because they were one of the few laboratories in the country best qualified to handle the scope and complexity of the project. This includes incineration testing experience, technical expertise in performing all tests required and unmatched capacity and is based on STL's specialization in air toxics, dioxin and explosive analyses and leadership in MS and LCMS analyses.

5.1.2 Department of Defense

Client	Project Type	Description
Consulting Firm	U.S. Navy – Pearl Harbor	STL supported a consulting firm and the US Navy on a large scale study at Pearl Harbor. As part of this project approximately 110 sediment, 30 waters and 45 tissues were analyzed for Alkyl Tin, Chlorinated Herbicides, Metals, Low-level SVOA, SIM PAH, P/PCB, Triazines/OP Pesticides, Explosives, acid volatile sulfides and simultaneously extracted metals (AVS/SEM), TOC and Carbamates.
Engineering Firm	U.S. Navy CLEAN – Atlantic Division	STL has performed analyses from 12 different Naval facilities, for a total of 24 phases. Services provided have included full CLP analyses, explosives, wet chemistry and geotechnical support. Electronic Data Deliverables (EDDs) have also been supplied.
Engineering Firm	U.S. Army Corps of Engineers	STL has been supporting a USACE project at Plattsburgh Air Force Base for two years. STL has performed full organic and inorganic CLP analyses on soil, groundwater and liquid matrices.

Client	Project Type	Description
U.S. Army Corps of Engineers	Quality Assurance Laboratory	STL has been recognized by the USACE as a Quality Assurance laboratory since 1993. USACE QA laboratories are chosen by a technical committee based on the laboratory's ability to meet a rigorous validation process that exceeds the requirements set for standard USACE validation.
U.S. Army Corps of Engineers	Landfill Closure	As part of a clean-up from a major hurricane, the U.S. Army Corps of Engineers contracted a national environmental firm to sample, analyze, and have a final report to them within 30 calendar days. A full range of parameters needed to be analyzed on this project. STL was able to provide all the required analytical services in 14 calendar days.
Engineering Firm	AFCEE	STL has provided support during several different project phases at Pease AFB. Many of the initial project samples were analyzed for GC/MS volatiles, semivolatiles, EDB, metals, PAHs, pesticides and wet chemistry analyses for nitrate, sulfate, alkalinity and free CO2. A groundwater remediation process for Site 32 was conducted on a rapid turn basis to monitor a treatment system. Analyses were conducted on volatiles, semivolatiles, pentachlorophenol, TSS and metals on a 48 hour turn basis for 6 weeks.
Engineering Firm	AFCEE	STL has provided analytical support for a confidential Air Force Plume Response Project since November 1996. Over 20,000 inorganic and organic analyses have been performed on water and sediment matrices including GC/MS volatiles and semivolatiles, EDB, pesticides/PCBs, herbicides, metals and more than 20 wet chemistry parameters.
Consulting Firm	U.S. Navy CLEAN II	STL has performed a full suite of organic and inorganic analyses following CLP and SW-846 protocols at over 40 Naval facilities on the west coast. Fully validatible and summary packages have been provided including EDDs in customized formats.
Consulting Firm	U.S. Navy BRAC – Northern Division	STL has been providing analytical services to a major consulting firm under an ID/IQ contract with the Navy Northern Division at over 30 Naval installations. Analyses performed have included a full suite of organic and inorganic constituents on aqueous, solid and tissue matrices in support of RI/FS, IRP, and Risk Assessment Programs.
Consulting Firm	AFCEE	STL has been providing analytical services in support of an RI/FS at Andersen AFB, Guam since 1994. All analyses have followed the strict guidelines of SW-846 protocols and the Andersen AFB Basewide Sampling and Analysis Plan (which STL has assisted with development). Matrices of a very complex nature, including monitor lizard tissue, have been analyzed under strict quality control limits. All data generated has been provided in "CLP-like" packages and electronically uploaded into ERPIMS.
Consulting Firm	AFCEE	Under guidance of the Hickam AFB Basewide Quality Assurance Plan and the AFCEE IRP Manual, STL has provided analytical support at several Air Force Bases in the Pacific Rim. Analyses of organic and inorganic constituents were performed on soil, sediment, groundwater and surface water samples.
U.S. Army Corps of Engineers	Various	STL has provided analytical support for the U.S. Army Corps of Engineer's site investigations nationwide since 1986. STL has routinely evaluated various sample matrices such as water, soil/sediment, plant, animal and fish tissues and air from over 16 USACE sites.

Client	Project Type	Description
Consulting Firm	AFCEE - RFI and Risk Assessment	Analytical support was provided to the RFI and Risk Assessment efforts that were performed simultaneously at Altus AFB. This was one of the largest funded projects for fiscal 1999. AFCEE protocols were followed and modified for APX IX analytes. Most of the 2,250 samples were analyzed for VOC, SVOC and metals, with Full deliverable data packages in hard copy and CD-ROM formats. EDDs were submitted in AFCEE's ERPIMS 4.0 format.
Major Consulting Firm	Permit to Continue Operations at Chemical Agent Disposal System	STL supported analysis at a hazardous waste treatment facility for the destruction of the chemical agent munitions stockpile in the South Pacific. The disposal system was designed to dispose of nerve agents, blister agents, drained munitions, contaminated refuse, bulk containers, liquid wastes, explosives, propellant component and other agent related waste. STL provided analytical support for the incinerator trial burns for the purpose of obtaining a new permit to continue operations that included liquid incinerator, metal parts furnace, dunnage incinerator and the deactivation furnace system. Analyses includes Dioxin/furans by Method 23, 8280 and 8290, PCB congeners by High resolution GS/MS, VOC, SVOC. Total chromatographic organics, metals by ICP/MS, Hexavalent Chromium by Method 0061, HCl and HF.

5.1.3 Industrial

Client	Project Type	Description
Fortune 100 Chemical Company	Remedial Investigation – Superfund Site	STL analyzed over 900 soil samples for TCL/TAL parameters over a nine-month period using CLP and SW-846 methodologies. Several types of extract clean-up procedures were required on many samples due to high levels of contamination. STL continues to provide analytical support to the company for on-going remediation and groundwater monitoring.
Oil Refiner	Discharge and Groundwater Monitoring	STL has provided analytical support at a major East Coast refinery. The bulk of the project has required the analysis of discharge water and groundwater for organics and inorganics using EPA 600 series methods. Sludges have been analyzed for TCLP parameters utilizing SW-846 methods.
Electrical Utility	Emergency Response	STL operates a program with a northeastern electrical utility to provide sampling and analysis for any type of spill or environmental incident. Over the last five years, STL has analyzed over 1,000 soil and oil samples for PCBs, and other samples for PAH, volatiles, semivolatiles and GC Fingerprinting.
Semiconductor Manufacturer	Permit Analysis	STL analyzes daily samples for a variety of organic and inorganic parameters that are permitted under SPDES and POTW. Emergency turnaround times of 24 hours or less are frequently required.
Railroad Company	Contract Laboratory	STL performs sampling and analyses on groundwater remediation sites, as well as analyses for consultants on hazardous spills, UST's and site investigations.

Client	Project Type	Description
Oil Company	Contract Laboratory	STL analyzes samples from gas station sites, bulk terminals, production facilities and property transfers. Samples are also analyzed for bioattenuation, air sparging and other remedial techniques. STL works with over 50 consultants on site assessments and investigations.
Southeastern Utility	Sampling and Analysis	STL provides sampling and analyses for a major southeastern utility company. Over 2000 monitoring wells are sampled and tested for metals and volatiles per year.
Soup Company	NPDES Monitoring	STL coordinates the environmental sampling schedule and provides analytical services for approximately 50 sites nationwide for a soup company. The scope of work includes wastewater sampling and analysis and potable water sampling and analysis. Project "Site Summaries" are provided to each site prior to each sampling event providing instructions, parameters, methods, detection limits, reporting requirements, and any specific details that are important to the successful execution of the program. At the completion of each project, the project manager reviews the analyses. If any permit levels are exceeded, immediate notification is given to the client.
Ordnance Manufacturer	Analytical Support	STL provides comprehensive analytical support for a major ordnance manufacturing facility. STL has experience with, and knowledge of, the methods and regulatory requirements associated with explosive residues and other materials common to this facility. EPA and state approved methods for the analysis of water, soil and waste materials are employed.
Chemical Company	Environmental Testing	STL has provided analytical support services in response to programs in support of RCRA, CERCLA, NPDES/CWA and CAA programs. A variety of matrices have been evaluated for environmental compliance, including water, soil/sediment and waste. Routine monitoring programs typically evaluate these matrices for volatile, semivolatile, and inorganic parameters for Appendix IX, TCL/TAL, Priority Pollutants and other target analytes of concern.
Major Steel Maker	Sampling & Analysis, NPDES, RCRA	STL coordinates and performs all aspects of this client's NPDES monitoring including sampling, analysis, data reduction and data reporting to agencies. This NPDES permit is the most extensive in the state of Indiana. STL coordinates all aspects of the company's waste characterization for over 30 waste streams within the facility. STL has developed electronic formats for all agency reporting requirements. STL works with various consulting and engineering firms who provide site investigations and process monitoring.
Major Electronics Company	Waste Characterization & Disposal	Over the past five years, STL has provided extensive waste characterization analysis and disposal decision assistance for a major electronics company. STL has provided customized electronic deliverables to facilities throughout the state of Texas. The laboratory was awarded that company's *'Superior Excellence Award"*

5.1.4 Mixed Waste

Client	Project Type	Description
Engineering Firm	Department of Energy – Mixed Waste	STL had been contracted to provide organic, inorganic and radiochemistry analyses on soil, aqueous, vegetation and air matrices on a weekly basis for waste and radiochemistry classification.
Environmental Engineering Firm	Department of Energy – Mixed Waste	STL was under contract with a large environmental consulting firm for the analysis of mixed waste samples collected from a DOE site in New York under a removal action plan. Approximately 80 samples were submitted for analysis within a two week period. The project included the analysis of soils and waters for CLP organics and inorganics (TCL/TAL); TCLP; and radiological parameters including Gross Alpha/Beta, Gamma Spectroscopy, Strontium 90 and Tritium. Data packages including comprehensive quality assurance information, were reported within four weeks and were fully validated by the contractor's quality assurance team.
Engineering Firm	U.S. Navy CLEAN	STL has analyzed soil, aqueous, waste and fish tissue matrices for organics, inorganics, wet chemistry and radiological analyses. Compliance with CLP and Navy CLEAN analytical protocols and deliverables is mandatory.

5.1.5 Air

Client	Project Type	Description
Oil Company	Air Stripper Monitoring	STL is under contract with an oil company for the analysis of tedlar bags and canisters for BTEX & TPH from UST sites throughout the United States. This work is done in support of air stripper monitoring.
Confidential	Groundwater Vapor Extraction	STL provides monthly canister analyses of a carbon vapor extraction system for Method 8260 volatile organic compounds at an Air Force Base in Ohio. Level III data deliverables are provided.
Confidential	Exposure Monitoring, Risk Assessment	STL provided air analyses for metals and TSP utilizing 8x10" QMA filters, PUF/XAD-2 cartridges for semivolatiles and Summa canisters for volatiles. These analyses were conducted in support of remediation at a Superfund Department of Defense site in Utah.
Major Engineering Firm	Long Term GW Monitoring Program	STL has provided air analysis in support of an AFCEE program that required TO14 and Method 18 analyses since 1993. QAPP development and weekly were reports provided to the consultant. Lab provided AFCEE I and II deliverables.
Major Consulting Firm	Trial Burn Demo Project - Site-Specific Risk Assessment	STL was under contract to evaluate and perform modifications to EPA methods on samples exhibiting highly acidic matrix. STL demonstrated that methods applied produced defensible and validatable results. STL assisted in the sample collection of off-gas from the combustion of high level radioactive, nitric acid solution containing hazardous metals. The following sampling trains were employed to collect the off-gas samples: Method 0030/0031, TO-14A, Method 0040 for VOC analysis, Method 0060 for metals, including Mercury; Modified Method 5 (0023A/0010) for PCDD/PCDF and PAH by high resolution GC/high resolution MS; Modified Method 0010 for SVOCs.

5.1.6 Geotechnical

Client	Project Type	Description
Engineering Firm	Field Investigation	STL analyzed subsurface soil samples for grain size, bulk density and porosity in support of a groundwater containment field investigation. In addition to the geotechnical parameters, soil samples were also analyzed for TOC, sulfate and cation exchange capacity. Groundwater samples were analyzed for TCL volatiles, TAL metals, cyanide, TSS, BOD, TOC and chloride.
Engineering Firm	Site Investigation	STL is currently providing analytical support to an engineering firm for their work at a site on the Housatonic River. As part of this project, STL is analyzing approximately 140 soils per month for particle size using ASTM Method D422.

5.1.7 On-Site Technologies Division

Client	Project Type	Description
Military Installation	DOD Site Investigation	STL's 45-foot mobile laboratory, equipped with GC/MS and a dual ECD GC, provided on-site analysis at a DOD site investigation. Analyses consisted of volatiles by 8260 and EDB by 504.1 to determine site assessment and plume delineation activities conducted at this military installation. STL's mobile laboratory provided data on 1 hour and 24 hour turnaround times. A complete CLP-type data package and electronic deliverables were provided every seven days. Average sample volume was 25 samples per day, with some days requiring the analysis of up to 50 samples.
Groundwater Pump & Treat Facility	USEPA NPL Superfund Site Remediation Project	STL is responsible for the management of this USACE validated on-site laboratory at a Superfund Pump & Treat Facility. Staffed with six full-time chemists, analyses of volatile and semivolatile organic compounds by GC/MS, pesticides by GC/ECD, metals by ICAP and selected wet chemistry parameters are completed. All results are reported with five days of sample receipt.
New England Municipality	USEPA NPL Superfund Site Monitoring	This two-phase project consisted of STL's on-site laboratory conducting soil analysis for PCBs, lead and copper on a 48-hour turnaround time. Over 3,500 samples were completed during this phase. The second phase was divided between STL's fixed laboratory and mobile laboratories and consisted of 24-hour turnaround time for lead and copper by XRF and GC/FID for PCB analysis.
Engineering Firm	AFCEE	STL's mobile laboratory provided analyses for EPA methods 8270 and 8021 at Griffis Air Force Base. Additional services included the electronic production of AFCEE 1996 QAPP 1.1 reporting forms.
Incineration Site	On-Site Characterization	STL provided the on-site characterization of drums, sludge and soils at an incineration site in Swartz Creek, Michigan. Soils were analyzed for organic constituents to verify the remediation effectiveness. STL also provided on-site air analyses for the duration of the project.
Engineering Firm	Sample Acquisition	STL completes all required environmental sampling activities for this regional engineering firm. Services

Client	Project Type	Description
		provided include sampling of groundwater, including low-flow technique; soil and sediments; wastewater, including time and flow-proportional composite sampling; surface waters; air and surface wipes. A range of on-site analyses is also performed and all work is completed under strict chain-of-custody protocols.
Various Industrial Firms	Waste Characterization	STL has supported various industrial firms in waste characterization utilizing their mobile laboratory facilities. STL analyzed samples from 13,000 drums of unknown waste materials at a Nashua, New Hampshire site and 15,000 drums of waste materials at a Toms River, New Jersey site.

5.1.8 Aquatic Toxicity

Client	Project Type	Description
Consulting Firm	Superfund Site Monitoring	STL was contracted by a regional environmental consulting firm to provide chronic toxicity testing services as final stage, confirmatory analyses at a remediation project in Massachusetts. Working with the consultant, STL assisted in designing the overall scope of work, including some modified testing protocols specifically designed for this project's needs, which were used to evaluate the remediation efforts recently completed at the project site. All testing protocols utilized for this project were reviewed and approved by the U.S. EPA.
Paper Company	Toxicity Identification (TIE) and Toxicity Reduction Evaluation (TRE) Studies	STL provided an international paper company with a variety of bioassay and chemical analyses relative to Toxicity Identification (TIE) and Toxicity Reduction Evaluation (TRE) studies. Both chronic and acute toxicity testing protocols were utilized and over 1000 screening toxicity tests were performed to monitor process changes within the facility.

5.1.9 Dredged Material Evaluation

Client	Project Type	Description

Client	Project Type	Description
Consulting Firm	U.S. Army Corps of Engineers and New York/New Jersey Port Authority	STL was contracted to provide analytical support for proposed upland disposal of dredged material to coal pits in Pennsylvania and West Virginia. Analytical services included a full suite of parameters including PCB congeners and SPLP waste characterization on bulk sediment prior to and following stabilization. All activities were performed under the strict quality control guidance of the *Management and Regulation of Dredging Activities in New Jersey's Tidal Waters (Draft, March 1996).*
U.S. Army Corps of Engineers	River Bottom Sediments	STL was contracted with the USACE for the analysis of river bottom sediments for pesticides/PCBs and a selected group of metals. Because these materials were bioaccumulative, STL modified methods of sample preparation to meet the USACE's low detection limits.
Consulting Firm	U.S. Army Corps of Engineers	STL developed a Quality Assurance Project Plan and performed chemical analyses of Chesapeake Bay sediment proposed for dredging in 1996 and 1997. Sediment, site water, and elutriate water were analyzed following procedures and target detection limits consistent with EPA guidelines provided in the *Inland Testing Manual (1994)* for dredged material disposal in inland waters.
Consulting Firm	U.S. Army Corps of Engineers	STL provided analytical support at Castle Astoria, New York for proposed ocean disposal of dredged material. Sediment, site water, elutriate water, and tissue matrices were analyzed for metals, pesticides, PCB congeners, PAHs, and TOC following the strict protocols of the *Green Book* and *EPA Region II Regional Implementation Manual.* For this project, STL developed a chelation extraction procedure for metals determination in site and elutriate water to meet all project required detection limits.
Consulting Firm	New York/New Jersey Port Authority	STL, in association with a major consulting firm, was tasked with finding acceptable disposal alternatives for natural red clay found in the navigation channels of the Newark Bay and Staten Island Kills Complex. Biota analyses were performed after a 28-day bioaccumulation period. All analyses were performed in accordance with the EPA Region II Regional Implementation Manual and on an accelerated turnaround.
U.S. Army Corps of Engineers	Dredged Material Evaluation	The U.S. Army Corps of Engineers requested that STL develop the data necessary to determine the continued suitability for ocean disposal of material proposed to be dredged during the construction of the Bayou Casotte Turning Basin and Pass Christian Harbor, Mississippi. Physical characteristics, chemical contamination, and bioaccumulation potential were compared to a reference area in the Mississippi Sound to determine similarity. A full suite of organic and inorganic analyses including AVS/SEM was performed on sediment and tissue matrices.

5.1.10 Tissue Analyses

Client	Project Type	Description

Client	Project Type	Description
U.S. Army, Rocky Mountain Arsenal	Biota Analysis	Under this contract, STL developed PMRMA approved analytical protocols for the low level determination of organochlorine pesticides, mercury, and arsenic on plant and animal tissue. Electronic data deliverables were provided in accordance with USACE IRDMIS requirements.
Consulting Firm	U.S. Navy CLEAN II – Ecological Risk Assessment Support	STL performed chemical analyses on sediment, soil, eluate, elutriate, water, small mammal, and animal tissue samples in support of an onshore ecological risk assessment of the Navy's Mare Island, California facility. This was a very challenging project due to the variety and complexity of matrices and large sample volume received within a very short window. All project and data quality objectives were met within the required timeframe.
Consulting Firm	U.S. Army Corps of Engineers	STL provided analytical services to a major consulting firm in support of a removal action at Fort Totten, New York. Fish, oyster, and mussel tissue were tested for mercury, one of the main contaminants of concern at the site.
U.S. Air Force, Armstrong Laboratories	Public Health & Ecological Risk Assessment Support	STL was contracted to provide analytical services in support of an investigation of the water, sediment, and biotic population quality of Leon Creek, which flows through Kelly AFB. Tissue samples from selected trophic levels in the stream were tested for a full suite of organic and inorganic constituents to calculate Biological Concentration Factors as part of the ecological risk assessment.
Consulting Firm	Ecology Risk Assessment Support	STL performed tissue analysis of fish, earthworms, and small mammals. Strict homogenization procedures were followed in preparation of small mammal analysis due to biohazard potential. Electronic data transfer files were provided in accordance with USAEC IRDMIS requirements.
Consulting Firm	Fish Tissue Analysis	STL evaluated concentrations of arsenic, mercury, PCBs, and organochlorine pesticides in the edible portions of fish from the Potomac and Anacostia River. Analyses were performed as part of the current NPDES permit for the Blue Plains WWTP.
Consulting Firm	U.S. Army Corps of Engineers	STL analyzed fish and shellfish for PCBs and metals to determine exposure to predators and estimate risk to human health. Additionally, tissue analyses were performed after a 28-day bioaccummulation exposure period in support of sediment evaluation activities.
Chemical Company	Fish Samples	STL's client needed to analyze thousands of fish samples of varying species and lipid content over a relatively short period of time. This project required the participation of a large number of laboratories and the client wanted to demonstrate and maintain comparability between all the laboratories' results. STL developed and validated a fish/biological tissue method specifically for this project, including the production of a fish tissue standard reference material for use by all the participating laboratories.
Environmental Firm	Analysis of Tissue	The analytical work provided for this project included the preparation and analysis of tissue from various plants and animals. The animal tissue consisted of that from the whole body homogenization of frogs, earthworms and voles. The analyses included pesticides and PCBs by Method 8080, semivolatile organics by Method 1625 and trace metals by Methods 6010/7471.

Client	Project Type	Description
Consulting Firm	Phase II and IIA Analytical Studies	STL has concluded Phase II and IIA analytical studies for PCB congeners in fish, tissue, soil and water on the Hudson River with a consulting firm as part of the Hudson River PCB Reassessment RI/FS under an ARCS contract with EPA Region II. Dual column capillary GC/ECD was used to quantify close to one thousand samples for over one hundred target congeners. High resolution coring was used in the project and PCB patterns were correlated to historical events on the river.
Various Clients	Various Tissue Analysis	Thousands of tissue samples have been analyzed for various clients over the past ten years. Tissue samples have included various animal tissue and organs from worms, birds, reptiles, caddis fly larvae, bovine blood, human blood serum bovine milk, plant tissue and insects.

5.1.11 Dioxin Analysis

Client	Project Type	Description
Major Paper Mill	Routine Monitoring and Process Control	STL conducts dioxin/furan analyses by Method 1613A and Method 8290 on sediment, influent, effluent, pulp, paper and fish tissues. Analysis of fish tissue has been done annually for a major paper company at various locations since 1988. In general, STL provides more than 100 dioxin/furan analysis on fish tissue sample for several pulp/paper clients throughout the United States.
Wastewater Treatment Plants	Monitoring Programs	STL provides dioxin/furan analysis to various municipalities and sanitation agencies utilizing methods 1613, 8280 and 8290 on aqueous, sludge, ocean sediment matrices. STL's history with some clients date back to 1990.
Consulting Engineers	Air Force Base	STL has provided routine analytical testing including dioxin/furan analysis by Method 8290 on soils, aqueous and liquid waste samples since 1992. All data provided included validatable data packages (CLP-like) and electronic deliverables in IRPMS format.
US Geological Survey	On-going Monitoring	STL provides dioxin analysis using Method 8290 to support on-going monitoring at Lake Tahoe, CA and Lake Mead, NV since 1995. Sediments, waters and semi-permeable membrane dialysates are analyzed.
EPA	Monitoring	STL has provided support for dioxin/furan analyses to Region IX EPA since 1995. Most projects conformed to project-specific QA/QC requirements with CLP-like forms presented in a validatable data package. Method 1613A for soils and waters used.
USDA	Analysis of Livestock Feed	STL provided analytical support to numerous poultry plants, catfish farms and a clay manufacturer involved in an investigation of potentially contaminated livestock and livestock feed. Over 100 samples were analyzed on a quick TAT (2 – 5 days) for 2,3,7,8-TCDD by Method 1613A. Samples included feed, clay, catfish filets, fish oil, eggs, poultry tissue and poultry fat.

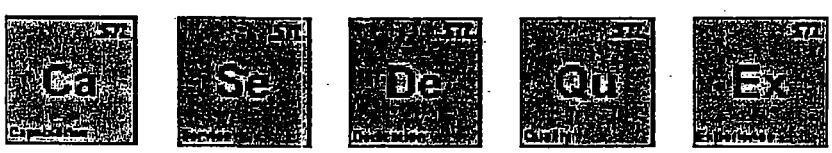
5.1.12 Radiochemistry

Client	Project Type	Description
U. S. Army Corps of Engineers	FUSRAP	STL, as an MRD validated and NRC approved laboratory, provides analytical support of three FUSRAP sites in St. Louis. In addition to the mixed waste analysis for VOC, SVOC, the laboratory also performs Gamma Spectroscopy and Isotopic Thorium. CLP-like data packages and ASCII data file electronic deliverables were reported. Period of performance: 1991 though 2001.
Department of Energy	Radiochemcial Bioassay and Environmental	DOE administers the bioassay program in support of remediation work for all contractors at the Hanford Site in Richland, Washington and the environmental program in support of site monitoring at Hanford. STL performs analysis for (routine and rapid TAT) of urine and fecal samples for the following isotopes: Americium, Curium, Plutonium, Strontium, Thorium, Tritium and Uranium (Isotopic and Total). STL also conducts analysis of air particulates, water, soil/sediment, milk, wine, vegetation, wildlife, vegetables and silica gel for the following additional isotopes: Carbon, Gamma isotopes, Gross Alpha & Beta, Iodine, Radium and Technetium.
Department of Energy	Radiochemistry Bioassay	STL supports a bioassay program in support of activities at several mid-western sites. The lab performs analysis of urine samples for routine turnaround times for Americium, Curium, Neptunium, Plutonium, Strontium, Technetium, Thorium, Tritium and Uranium (Isotopic and Total).
Department of Energy	Radiochemical Environmental and Waste Characterization	STL performs analysis of water, soil/sediment, building materials, concrete and waste for routine and rapid TAT for the following isotopes: Americium, Carbon, Curium, Gamma Isotopes, Gross Alpha and Beta, Iodine, Neptunium, Plutonium, Radium, Strontium, Technetium, Thorium, Tritium and Uranium (Isotopic and Total). This analyses is in support of the remediation work at the Hanford site in Richland, WA.

SEVERN TRENT LABORATORIES

APPENDIX A

Table of Analytical Services



Analytical Fraction	Methods	STL AASG (Denver)	STL Anchorage	STL Austin	STL Baltimore	STL Buffalo	STL Burlington	STL Chicago	STL Connecticut	STL Corpus Christi	STL Denver	STL Edison	STL Houston	STL Knoxville	STL Los Angeles	STL Miami	STL Mobile	STL Newburgh	STL North Canton	STL On-Site Technologies	STL Pensacola	STL Pittsburgh	STL Richland	STL Sacramento	STL Savannah	STL St. Louis	STL Tallahassee	STL Tampa East	STL Tampa West	STL Valparaiso	STL Westfield & STL Billerica+
Volatiles by GC/MS - PP/TCL/TTO																															
Volatiles, Drinking Water	EPA 524.2					x	x	x	x		x	x			x	x	x	x				x		x	x	x	x	x	x	x	x
Volatiles	EPA 624		x		x	x	x	x	x	x	x	x	x			x	x	x	x		x	x	x		x	x	x	x	x	x	x
Volatiles	SW 5030B / 8260B		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Volatiles	SW 5035B / 8260B		x	x	x	x	x	x	x	x	x	x		x	x	x	x		x	x	x	x	x	x	x	x	x	x	x	x	
Volatiles, Appendix IX List	SW 8260B		x	x	x	x	x	x	x	x	x			x		x		x	x		x	x	x		x	x	x		x	x	
Volatiles	EPA SOW OLM03.2				x	x	x	x	x			x		x					x		x	x	x		x	x	x				
Volatiles	EPA SOW OLM04.1 ****					x	x	x											x				x								
Volatiles, Low Level	CLP SAMLC (OLCO2.1)				x	x	x	x				x		x					x			x	x		x	x					
Tentatively Identified Compounds (TICs)	EPA 624, SW 8260B, EPA 524.2		x	x	x	x	x	x	x	x	x	x		x	x	x	x	x	x	x	x	x	x		x	x	x	x	x	x	x
Volatiles, Isotope Dilution	1624						x																		x	x					
Volatiles, Vacuum Distillation	1624						x																		x	x					
Soil Volatile Methanol Prep	State Specific		x	x	x	x	x		x	x		x				x	x	x		x	x	x		x	x		x	x	x	x	x
Volatiles by GC																															
Volatiles, Drinking Water	EPA 502.2					x	x											x													
VOC Purgeable Halocarbons	EPA 601					x	x				x	x	x				x	x	x		x				x		x	x	x		x
VOC Purgeable Halocarbons	SW 5030B / 8021B					x	x			x	x	x				x	x	x	x	x	x			x	x		x		x	x	x
VOC Purgeable Halocarbons	SW 5035 / 8021B					x	x*			x	x					x			x	x	x			x	x					x	
VOC Purgeable Aromatics (BTEX/DCB/CB only)	EPA 602		x		x	x	x	x		x	x	x	x				x	x	x		x			x	x	x	x	x	x		x
VOC Purgeable Aromatics (BTEX/DCB/CB only)	SW 5030B / 8021B		x		x	x	x	x		x	x	x			x	x	x	x	x	x	x			x	x		x	x	x	x	x
VOC Purgeable Aromatics	SW 5035 / 8021B		x			x	x*			x	x				x	x			x	x	x			x	x					x	
VOC (in Series)	601 / 602 / SW 5030B / 8010B / 8021B					x	x				x		x			x	x	x	x		x			x	x		x	x	x		x
Full Method List (1)	SW 5030B / 8021B					x	x									x		x	x	x	x			x	x						
Full Method List (1)	SW 5035 / 8021B					x	x*									x			x	x	x			x	x						
BTEX and GRO (Plus MTBE)	Mod. SW 5030B / 8015B / 8021B			x	x	x	x	x			x				x	x	x	x	x	x	x			x	x	x	x	x	x	x	
BTEX and GRO (Plus MTBE)	SW 5035 / 8015 / 8021B				x	x	x*				x				x	x			x	x	x			x	x	x				x	

Analytical Fraction	Methods	STL AASG (Denver)	STL Anchorage	STL Austin	STL Baltimore	STL Buffalo	STL Burlington	STL Chicago	STL Connecticut	STL Corpus Christi	STL Denver	STL Edison	STL Houston	STL Knoxville	STL Los Angeles	STL Miami	STL Mobile	STL Newburgh	STL North Canton	STL On-Site Technologies	STL Pensacola	STL Pittsburgh	STL Richland	STL Sacramento	STL Savannah	STL St. Louis	STL Tallahassee	STL Tampa East	STL Tampa West	STL Valparaiso	STL Westfield & STL Billerica+
BTEX (Plus MTBE)	SW 5030B / 8021B			X	X	X	X	X		X	X	X	X		X	X	X	X	X	X	X			X	X	X	X	X	X	X	X
BTEX (Plus MTBE)	SW 5035 / 8021B				X	X	X*			X	X				X	X			X	X	X			X	X	X					
Gasoline Range Organics (GRO) CA LUFT	Mod. SW 5030B / 8015			X	X	X	X	X			X	X	X		X				X		X			X		X		X			X
Gasoline Range Organics (GRO)	Mod. SW 5035 / 8015			X	X	X	X*				X	X				X				X	X			X	X			X		X	X
Gasoline Range Organics (GRO)	SW 5030B/8015B																			X				X		X		X			
Gasoline Range Organics (GRO) Alaska	AK101		X		X										X									X							
Gasoline Range Organics (GRO) WA, OR	NWTPH-GX				X																										
Gasoline Range Organics (GRO) Maine	4.2.17				X																										
Gasoline Range Organics (GRO) Tennessee																											X				
Volatile Petroleum Hydrocarbons	MADEP VPH (2)						X														X				X		X				X
Volatile Petroleum Hydrocarbons (Iowa)	OA-1				X						X															X					
DBCP & EDB	EPA 504.1				X	X	X	X							X	X	X	X		X	X	X		X	X	X	X	X	X		
DBCP, TCP and EDB	SW 8011					X	X									X					X					X		X			
DBCP & EDB	SW 8011				X	X		X								X	X			X	X				X	X	X	X	X		
GC Fingerprint Scan	Mod. SW 8015		X		X	X			X	X		X				X	X	X	X	X	X			X	X		X	X	X	X	X
VOC-DAI-Direct Aqueous Injection	SW 8015B			X		X			X		X	X				X	X	X			X			X	X						X
VOC-DAI - Appendix IX List	SW 8015B			X		X			X							X	X								X						
VOC-DAI (HAPS)	NCASI																X								X						
Alcohols (Select List)	SW 8015B			X			X	X	X		X					X			X						X	X				X	
PHC	QAM-025-10/91																														
Soil Volatile Methanol Prep, each	State Specific		X	X	X	X	X		X	X		X				X	X	X		X	X			X	X	X	X	X	X	X	X
MN - VOC	EPA 465E & 465C, State 465D																		X												
Semivolatiles by GC/MS - PP/TCL/TTO																															
Semivolatiles	EPA 525					X										X	X	X													
Semivolatiles	EPA 625 / SW 8270C	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X
Semivolatiles, Appendix IX List	SW 8270C			X	X	X	X	X	X	X	X			X		X		X	X		X	X		X	X	X	X			X	

SEVERN TRENT LABORATORIES

Analytical Fraction	Methods	STL AASG (Denver)	STL Anchorage	STL Austin	STL Baltimore	STL Buffalo	STL Burlington	STL Chicago	STL Connecticut	STL Corpus Christi	STL Denver	STL Edison	STL Houston	STL Knoxville	STL Los Angeles	STL Miami	STL Mobile	STL Newburgh	STL North Canton	STL On-Site Technologies	STL Pensacola	STL Pittsburgh	STL Richland	STL Sacramento	STL Savannah	STL St. Louis	STL Tallahassee	STL Tampa East	STL Tampa West	STL Valparaiso	STL Westfield & STL Billerica+
Semivolatiles	EPA SOW OLM03.2				x	x	x	x	x			x		x					x		x	x			x	x	x				
Semivolatiles	EPA SOW OLM04.1 ****					x	x	x											x			x									
Semivolatiles, Low Level	CLP SAMLC (OLCO2.1)					x	x	x	x			x		x					x			x			x		x				
Semivolatiles, Isotopic Dilution	1625						x																								
Polynuclear Aromatic Hydrocarbons (PAHs)	EPA 625 / SW 8270C	x	x	x	x	x	x	x	x	x	x	x		x	x	x	x	x	x	x	x	x		x	x	x	x	x	x	x	x
PAHs GC/MS SIM Low Level	Ion Trap Spy Inject GC/MS													x		x															
PAHs GC/MS SIM Low Level	STL Method	x	x				x																	x							
PAHs GC/MS Scan Low Level	SW 8270C	x	x											x								x		x	x	x					
Tentatively Identified compounds	All Methods	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x		x	x	x	x	x	x		x
Dioxins / Furans	SW 8280													x										x	x						
TCDD	EPA 613													x										x	x						
Semivolatiles by GC																															
Diesel Range Organics (DRO)	Mod. SW 3510/3550/8015B		x	x	x	x	x	x	x	x	x	x	x			x	x	x	x	x	x			x	x	x	x	x	x	x	x
Diesel Range Organics (DRO) CA LUFT	CA LUFT			x	x		x	x			x		x		x				x		x			x		x		x			
Diesel Range Organics (DRO)	WI DNR (13)				x	x													x					x		x		x			
Diesel Range Organics (DRO) Alaska	AK102		x		x										x									x							
Diesel Range Organics (DRO) WA,OR	NWTPH-DX				x																										
Diesel Range Organics (DRO) Maine	4.1.25				x																										
Total Chromatographable Organics (TCO)	Mod. SW 8015			x												x					x			x							
Alaska Residual Range Organics	AK103		x		x										x									x							
Florida Petroleum Residual Organic	FL-PRO (3)				x											x	x		x		x				x		x	x	x		
Texas Total Petroleum Hydrocarbons	TNRCC Method 1005				x					x			x								x				x						
Phenols	EPA 604/SW 8040												x													x					
Polynuclear Aromatic Hydrocarbons	SW 8100				x	x				x						x	x			x	x				x		x		x		
Extractable Petroleum Hydrocarbons	TN EPH (4)					x		x													x				x		x				
Extractable Petroleum Hydrocarbons	MADEP EPH (5)						x														x				x		x				x
Extractable Petroleum Hydrocarbons (Iowa)	OA-2				x						x															x					

Analytical Fraction	Methods	STL AASG (Denver)	STL Anchorage	STL Austin	STL Baltimore	STL Buffalo	STL Burlington	STL Chicago	STL Connecticut	STL Corpus Christi	STL Denver	STL Edison	STL Houston	STL Knoxville	STL Los Angeles	STL Miami	STL Mobile	STL Newburgh	STL North Canton	STL On-Site Technologies	STL Pensacola	STL Pittsburgh	STL Richland	STL Sacramento	STL Savannah	STL St. Louis	STL Tallahassee	STL Tampa East	STL Tampa West	STL Valparaiso	STL Westfield & STL Billerica+
Alkyltins	STL Method						X																								
Percent Lipids	STL Method																		X					X							
Immunoassay Screen (Herb)	EPA 4015																		X	X											
Phenols	SW8041																					X									
Pesticides / PCBs																															
Pesticides/PCBs Drinking Water	EPA 505															X		X													
Organochlorine Pesticides / PCBs	EPA 608 / SW 8081A/8082		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X
Organochlorine Pesticides / PCBs, Apx IX List	SW 8081A/8082			X	X	X	X	X	X	X	X			X		X	X	X	X		X	X		X	X	X	X	X	X	X	
Organochlorine Pesticides / PCBs	EPA SOW OLM03.2				X	X	X	X	X			X		X					X		X	X			X	X	X				
Organochlorine Pesticides / PCBs	EPA SOW OLM04.1****					X	X	X											X			X									
Organochlorine Pesticides / PCBs	CLP SAMLC (OLCO2.1)					X	X	X	X													X			X		X				
Organochlorine Pesticides	EPA 608 / SW 8081A		X	X	X	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X
Polychlorinated Biphenyls (PCBs)	SW 8082		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X
Polychlorinated Biphenyls (PCBs) in oil	SW 3580A/8082			X	X	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X		X	X	X	X	X	X	X	
Triazine Pesticides	EPA 619						X				X					X	X								X		X				
Organophosphorous Pesticides	SW 8141A			X	X	X	X		X	X	X	X				X	X		X		X	X			X		X	X			
Organophosphorous Pesticides, Apx IX List	SW 8141A			X			X	X	X		X					X	X	X	X		X	X			X		X				
PCB Congeners	GC/MS Method 680			X								X												X	X						
PCB Congeners	STL Method (8082)				X		X																		X						
PCB Coplanars	STL Method				X		X																	X							
Herbicides																															
Chlorinated Herbicides, Drinking Water	EPA 515.1					X										X	X	X				X			X		X		X		
Chlorinated Herbicides	EPA 615						X				X					X	X		X		X				X		X		X		
Chlorinated Herbicides, Appendix IX List	SW 8150B							X			X					X	X							X	X	X	X		X		
Chlorinated Herbicides	SW 8151A			X	X	X	X		X		X	X	X			X	X	X	X		X	X		X	X	X	X	X	X		
Chlorinated Herbicides (exc. MCPP/MCPA)	SW 8151A			X	X	X	X	X			X					X	X		X			X		X	X	X	X	X	X		
Chlorinated Herbicides, Appendix IX List	SW 8151A			X	X	X	X	X	X		X					X	X	X	X		X	X		X	X	X	X		X		

SEVERN TRENT LABORATORIES

Analytical Fraction	Methods	STL AASG (Denver)	STL Anchorage	STL Austin	STL Baltimore	STL Buffalo	STL Burlington	STL Chicago	STL Connecticut	STL Corpus Christi	STL Denver	STL Edison	STL Houston	STL Knoxville	STL Los Angeles	STL Miami	STL Mobile	STL Newburgh	STL North Canton	STL On-Site Technologies	STL Pensacola	STL Pittsburgh	STL Richland	STL Sacramento	STL Savannah	STL St. Louis	STL Tallahassee	STL Tampa East	STL Tampa West	STL Valparaiso	STL Westfield & STL Billerica+
GC / GC/MS Clean Up																															
Alumina Cleanup	SW 3610B	X					X	X	X	X				X		X			X					X							
Alumina Cleanup	SW 3611B									X		X		X			X							X	X		X				
Florisil Cleanup	SW 3620B				X	X	X	X	X	X	X	X		X		X	X	X	X	X	X		X	X	X	X			X	X
Silica Gel Cleanup	SW 3630C						X		X	X				X		X		X	X	X	X			X	X	X	X				X
GPC	SW 3640A			X	X	X	X	X	X		X	X		X		X		X	X	X	X	X		X	X	X	X				X
Acid-Base Partition Cleanup	SW 3650B (Mod.)			X		X	X		X			X		X		X		X	X	X	X	X		X	X		X				X
Sulfur Cleanup	SW 3660B			X	X	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X
Acid Cleanup	SW 3665A		X		X	X	X	X	X	X	X			X	X	X	X		X	X		X		X	X	X	X	X	X	X	
High Performance Liquid Chromatography - HPLC																															
Polynuclear Aromatic Hydrocarbons (PAHs)	EPA 610				X		X	X			X								X		X	X		X	X	X	X	X		X	
Polynuclear Aromatic Hydrocarbons (PAHs)	SW 8310				X		X	X			X								X		X	X		X	X	X	X	X		X	
Explosives	SW 8330				X		X	X			X			X										X		X	X				
Explosives	CHPPM				X																			X							
Carbamates	EPA 531.1					X																									
Carbamates	EPA 632					X	X									X											X				
INORGANIC FRACTIONS - Metals																															
PP Metals (13)	200.7, 245.1 / SW 6010B, 7470A/7471A			X	X	X	X	X	X	X	X	X	X	X		X	X	X	X	X	X	X		X	X	X	X	X	X	X	X
TAL Metals (23)	200.7, 245.1 / SW 6010B, 7470A/7471A			X	X	X	X	X	X	X	X	X	X	X		X	X	X	X	X	X	X		X	X	X	X	X	X	X	X
TAL Metals (23)	EPA SOW ILM04.0				X	X	X	X	X			X		X			X		X		X	X			X	X	X		X		
RCRA Metals (7)	200.7, 245.1 / SW 6010B, 7470A/7471A			X	X	X	X	X	X	X	X	X	X	X		X	X	X	X	X	X	X		X	X	X	X	X	X	X	X

Analytical Fraction	Methods	STL AASG (Denver)	STL Anchorage	STL Austin	STL Baltimore	STL Buffalo	STL Burlington	STL Chicago	STL Connecticut	STL Corpus Christi	STL Denver	STL Edison	STL Houston	STL Knoxville	STL Los Angeles	STL Miami	STL Mobile	STL Newburgh	STL North Canton	STL On-Site Technologies	STL Pensacola	STL Pittsburgh	STL Richland	STL Sacramento	STL Savannah	STL St. Louis	STL Tallahassee	STL Tampa East	STL Tampa West	STL Valparaiso	STL Westfield & STL Billerica+
ICP Metals	EPA 200.7 / SW 6010B			x	x	x	x	x	x	x	x	x	x	x		x	x	x	x	x	x	x		x	x	x	x	x	x	x
ICP Metals	EPA SOW ILMO4.0				x	x	x	x	x			x		x			x		x		x	x			x		x		x	x	
Furnace Metals	EPA 200 Series, 7000 Series			x	x	x		x	x	x	x		x			x	x	x		x	x	x		x	x	x	x	x	x	x	x
Furnace Metals	EPA SOW ILMO4.0				x	x		x	x								x	x			x	x			x	x	x		x		
Furnace Metals	EPA 200.9				x	x		x	x							x	x	x			x				x		x		x	x	
Furnace Metals	SM1311B										x																				
Mercury-Hg (cold vapor)	EPA 245.1, SW 7470A/7471A			x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x		x	x	x	x	x	x	x	x
Mercury-Hg (cold vapor)	EPA SOW ILMO4.0				x	x	x	x	x			x		x			x		x		x	x			x	x	x		x		
Metals Preparation	SW 3050B			x	x	x	x	x	x	x	x	x		x		x	x	x	x	x	x	x		x	x	x	x	x	x	x	x
Metals Preparation	SW 3005A, SW 3010A, SW3020A			x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x		x	x	x	x	x	x	x	x
Metals Preparation	SW3051, CEM, SW3052			x										x																		
Metals Preparation	SM3030C, SM3030E										x													x							
TCLP	SW 1311			x	x	x	x	x	x	x	x		x	x	x	x	x	x	x	x	x	x	x		x	x	x	x	x	x	x	x
SPLP	SW 1312			x	x	x	x	x	x	x	x			x	x	x	x	x	x	x	x	x	x		x	x	x	x	x	x	x	x
CA W.E.T. Test	CA Title 22			x	x			x	x		x			x	x									x		x					
Metals, Appendix IX	SW 6010B, 7000 Series			x	x	x	x		x	x	x			x	x		x		x			x		x	x	x	x	x	x		
Metals, Appendix II	SW 6010B, 7000 Series			x	x	x				x	x			x	x		x		x			x									
MEP (Multiple Extraction Procedure)						x																x		x	x	x	x	x	x		
SPECIAL TEST CATEGORIES *Air Analysis* *NIOSH Methods:*																															
GC/MS Confirmation of GC Components	Mod. SW 5030B / 8260						x									x					x			x	x						x
GC/MS Screen (10 TICs) Non-quantitative	Mod. SW 5030B / 8260															x				x	x			x	x						x
Aldehyde Screen	NIOSH 2539																														x
GC/FID Screen (non-quantitative)																				x					x						x
BTEX	NIOSH 1501																								x						x

SEVERN TRENT LABORATORIES

Analytical Fraction	Methods	STL AASG (Denver)	STL Anchorage	STL Austin	STL Baltimore	STL Buffalo	STL Burlington	STL Chicago	STL Connecticut	STL Corpus Christi	STL Denver	STL Edison	STL Houston	STL Knoxville	STL Los Angeles	STL Miami	STL Mobile	STL Newburgh	STL North Canton	STL On-Site Technologies	STL Pensacola	STL Pittsburgh	STL Richland	STL Sacramento	STL Savannah	STL St. Louis	STL Tallahassee	STL Tampa East	STL Tampa West	STL Valparaiso	STL Westfield & STL Billerica+
BTEX and TPH	Mod. SW 8015B / 8021B, EPA 18															X					X			X	X					
Naphthas	NIOSH 1550																													X
Pesticides (GC-ECD)	NIOSH 1550																													X
Chlordane	NIOSH 5278																													X
PCBs in Air, Oil or Wipe	NIOSH 5503																							X						X
Polynuclear Aromatic Hydrocarbons (PAH)	NIOSH 5515																													X
Phenols	NIOSH 3502																													X
Metals by ICP	NIOSH 7300																				X				X					X
Metals by Graphite Furnace	NIOSH 7300																				X				X					X
Mercury	NIOSH 6009																				X				X					X
Formaldehyde	NIOSH 3508																													X
Cyanide	NIOSH 7904																								X					X
Nuisance Dust	NIOSH 0500, PM10																							X						X
Ambient Air																														
Volatile Aromatic Hydrocarbons	TO-1 (6)								X						X						X				X					
Volatiles	TO-2								X						X	X									X					
BTEX & MTBE	TO-3														X															
Pesticide by GC	TO-4			X					X					X		X	X							X	X					
Polyaromatic Hydrocarbons by GC/MS	TO-13 (6)			X					X				X	X		X	X				X			X	X					
Polyaromatic Hydrocarbons by SIM	TO-13 (6)															X	X				X			X	X					
Canister Sample by GC/MS	Mod. TO-14 (6)			X			X						X	X	X	X					X				X					
Canister Sample by GC/MS - SIM	Mod. TO-14 (6)														X	X					X				X					
Tentative Identified Compounds (TICs + 10)	Mod. TO-14 (6)			X			X						X	X	X	X					X				X					
Canister Sample by GC/MS (Polar/Non-Polar)	TO-15						X																							
Rental - 6 liter Summa Canisters	-			X			X						X	X	X	X					X				X					
Purchase of TENAX tubes, tedlar bags	-						X		X				X	X	X	X					X				X					
Gases																														
Dissolved Gases	RSK-175						X								X										X					

SEVERN TRENT LABORATORIES

Analytical Fraction	Methods	STL AASG (Denver)	STL Anchorage	STL Austin	STL Baltimore	STL Buffalo	STL Burlington	STL Chicago	STL Connecticut	STL Corpus Christi	STL Denver	STL Edison	STL Houston	STL Knoxville	STL Los Angeles	STL Miami	STL Mobile	STL Newburgh	STL North Canton	STL On-Site Technologies	STL Pensacola	STL Pittsburgh	STL Richland	STL Sacramento	STL Savannah	STL St. Louis	STL Tallahassee	STL Tampa East	STL Tampa West	STL Valparaiso	STL Westfield & STL Billerica+
Methane & Fixed Gases (CO, CO2, CH4, N2, O2)	STL Method / ASTM D1946			x			x								x						x				x					
Fixed Gases	ASTM D1946			x			x							x	x															
Specialty Organics by HRGC/HRMS																														
Dioxins/Furans	8280													x										x						
Dioxins/Furans	8290													x										x						
Dioxins/Furans	1613													x										x						
PCBs (Congeners)	1668 (Mod)													x										x						
Pesticides	STL Method													x										x						
Polynuclear Aromatic Hydrocarbons	CARB 429 (Mod)													x										x						
Specialty Organics by HPLC/MS																														
Triazines		x																						x						
Carbamates		x																						x						
Explosives		x																						x						
Chemical Warfare Degradates																								x						
Impurity identification under GLP		x																												
HPLC/MS method development		x																												
Source Testing																														
Volatile Organic Sampling Trains	0030/5041A/8260B													x																
Semi-Volatiles	0010/3542/8270C													x										x						
Pesticides	0010/3542/8081A													x										x						
PCBs (Congeners)	0010/3542/1668 (Mod)													x										x						
Dioxins/Furans	0023A/8290													x										x						
Dioxins/Furans	Method 23													x										x						
Polynuclear Aromatic Hydrocarbons	0010/3542/CARB 429 (Mod)													x										x						
Total Chromatographical Organics/Gravimetric	0010/3542/EPA TCO/Grav													x										x						
Multi-metals train	0060/6010B/7471A													x										x						
Multi-metals train	Method 29/6010B/7471A													x										x						

Analytical Fraction	Methods	STL AASG (Denver)	STL Anchorage	STL Austin	STL Baltimore	STL Buffalo	STL Burlington	STL Chicago	STL Connecticut	STL Corpus Christi	STL Denver	STL Edison	STL Houston	STL Knoxville	STL Los Angeles	STL Miami	STL Mobile	STL Newburgh	STL North Canton	STL On-Site Technologies	STL Pensacola	STL Pittsburgh	STL Richland	STL Sacramento	STL Savannah	STL St. Louis	STL Tallahassee	STL Tampa East	STL Tampa West	STL Valparaiso	STL Westfield & STL Billerica+
Anion Impinger Solutions (Cl, F, Br)	0050/9056/9057													x										x						
Air train particulate Filters	PM-10													x										x						
Media preparation	VOST, XAD, filters													x										x						
Asbestos Analysis / Industrial Hygiene																														
Polarized Light Microscopy (PLM)	EPA 600/M4-82-020																				x									x
Phase Contrast Microscopy (PCM)	PCM NIOSH 7400																				x									x
Transmission Electron Microscopy (TEM)	EPA Phase II 600/4-83-042																													x
Non-Friable Organically Bound	PLM/TEM																													x
Chemical Degradation Agents																														
Thiodiglycol	STL Method				x																			x			x			
DIMP/DMMP	STL Method				x																			x						
IMPA/MPA	STL Method				x																			x						
Organosulfur Compounds	STL Method				x																			x						
BZ	STL Method				x																			x						
Nitroguanidine	STL Method													x										x						
Nitrocellulose	STL Method													x										x						
Perchlorates (in process)	STL Method													x										x						
Microscopy Services																														
Scanning Electron Microscopy (SEM)	SEM																													x
SEM with X-ray Spectroscopy	EDX, WEDX																													x
TEM with X-ray Spectroscopy	TEM-EDX																													x
Computer Assisted Microscopy:																														
PSA	TEM 200+, SEM, Light Microscopy																													x
Fourier Transfer Infra Red Spectroscopy	FTIR																													x
Hardness Testing																														x

Analytical Fraction	Methods	STL AASG (Denver)	STL Anchorage	STL Austin	STL Baltimore	STL Buffalo	STL Burlington	STL Chicago	STL Connecticut	STL Corpus Christi	STL Denver	STL Edison	STL Houston	STL Knoxville	STL Los Angeles	STL Miami	STL Mobile	STL Newburgh	STL North Canton	STL On-Site Technologies	STL Pensacola	STL Pittsburgh	STL Richland	STL Sacramento	STL Savannah	STL St. Louis	STL Tallahassee	STL Tampa East	STL Tampa West	STL Valparaiso	STL Westfield & STL Billerica+
ICP-MS	EPA 200.8, SW 6020					x					x													x		x					
Radiological Services																															
Water / Wastewater																															
Americium-Isotopic (Am-241)	Mod. HASL-300 (10)																						x			x					
Carbon-14 (C-14)	Mod. EPA C-01 (8)																						x								
Curium-244 (Cm0244)	HASL-300 Mod.																									x					
Carbon-14 (C-14)	Mod. EPA C-01 (7)																									x					
Curium-Isotopic (Cm-242, 244)	Mod. HASL-300 (10)																						x								
Gamma Spectroscopy	Mod. EPA 901.1 (7)																									x					
Gamma Spectroscopy	ASTM D3649-91																						x								
Gross Alpha / Gross Beta	Mod. EPA 900.0 (7)																									x					
Gross Alpha / Gross Beta	EPA 9310																						x								
Neptunium-237 (Np-237)	Mod. HASL-300 (10)																						x								
Plutonium-Isotopic (Pu-238, 239/240)	Mod. HASL-300 (10)																						x								
Radium-226	EPA 903.1 (7)																						x			x					
Radium-228	Mod. EPA 904.0																						x			x					
Radium-Total Alpha Emitters	EPA 903.0 (7)																									x					
Radium-Total Alpha	Mod. ASTM D2460																						x								
Strontium-90	Mod. DOE RP500 (9)																									x					
Strontium-90	Mod. HASL-300 (10)																						x								
Technetium-99 (Tc-99)	Mod. DOE RP550 (9)																									x					
Technetium-99 (Tc-99)	Mod. HASL-300 (10)																						x								
Thorium-Isotopic (Th-228, 230, 232)	Mod. HASL-300 (10)																						x								
Tritium	Mod. EPA 906.0 (7)																						x			x					
Isotopic Plutonium (Pu-238, 239. 240)	HASL-300 (10)																									x					
Isotopic Thorium (Th-228, 230, 232)	HASL-300 (10)																									x					
Uranium-Isotpoic (U-234, 235, 238)	Mod. HASL-300 (10)																						x			x					
Uranium-Total (U)	ASTM D5174-91																						x								

SEVERN TRENT LABORATORIES

Analytical Fraction	Methods	STL AASG (Denver)	STL Anchorage	STL Austin	STL Baltimore	STL Buffalo	STL Burlington	STL Chicago	STL Connecticut	STL Corpus Christi	STL Denver	STL Edison	STL Houston	STL Knoxville	STL Los Angeles	STL Miami	STL Mobile	STL Newburgh	STL North Canton	STL On-Site Technologies	STL Pensacola	STL Pittsburgh	STL Richland	STL Sacramento	STL Savannah	STL St. Louis	STL Tallahassee	STL Tampa East	STL Tampa West	STL Valparaiso	STL Westfield & STL Billerica+
Solids																														
Americium-Isotopic (Am-241)	Mod. HASL-300 (10)																						x			x				
Carbon-14 (C-14)	Mod. EPA C-01 (8)																						x							
Curium-Isotopic (Cm-242, 244)	Mod. HASL-300 (10)																						x							
Gamma Spectroscopy	HASL-300 (10)																									x				
Gamma Spectroscopy	ASTM D3649-91																						x							
Gross Alpha / Gross Beta	DOE RP 720																									x				
Gross Alpha / Gross Beta	EPA 9310 / SM16																						x							
Neptunium-237 (Np-237)	Mod. HASL-300 (10)																						x							
Plutonium-Isotopic (Pu-238, 239/240)	Mod. HASL-300 (10)																						x							
Radium-226	HASL-300																									x				
Radium-226	ASTM D3649-91																						x							
Radium-228	Mod. EPA 904.0																									x				
Radium-228	ASTM D3649-91																						x							
Radium-Total Alpha	Mod. ASTM D2460																						x							
Strontium-90	Mod. DOE RP500 (9)																													
Strontium-90	Mod. HASL-300 (10)																						x							
Technetium-99 (Tc-99)	Mod. DOE RP550 (9)																									x				
Technetium-99 (Tc-99)	Mod. HASL-300 (10)																						x							
Thorium-Isotopic (Th-228, 230, 232)	HASL-300 (10)																						x							
Tritium	Mod. PNL-ALO-441																													
Tritium	Mod. EMSL-LV-0539-17																						x							
Isotopic Plutonium (Pu-238, 239. 240)	HASL-300 (10)																									x				
Isotopic Thorium (Th-228, 230, 232)	HASL-300 (10)																									x				
Uranium-Isotopic (U-234, 236, 238)	HASL-300 (10)																						x			x				
Uranium-Total (U)	ASTM D5174-91																						x							
Drinking Water																														
Gamma Spectroscopy	EPA 901.1																						x							

Analytical Fraction	Methods	STL AASG (Denver)	STL Anchorage	STL Austin	STL Baltimore	STL Buffalo	STL Burlington	STL Chicago	STL Connecticut	STL Corpus Christi	STL Denver	STL Edison	STL Houston	STL Knoxville	STL Los Angeles	STL Miami	STL Mobile	STL Newburgh	STL North Canton	STL On-Site Technologies	STL Pensacola	STL Pittsburgh	STL Richland	STL Sacramento	STL Savannah	STL St. Louis	STL Tallahassee	STL Tampa East	STL Tampa West	STL Valparaiso	STL Westfield & STL Billerica*
Gross Alpha / Gross Beta	EPA 900.0 (7)																						x			x					
Radium-226	EPA 903.1																						x			x					
Radium-228	EPA 904.0																						x			x					
Radium-Gross Alpha	Mod. ASTM D2460																						x								
Radon-222 (Rn-222)	EPA 913.0																						x								
Strontium-90	EPA 905.0 (7)																									x					
Strontium-90	Mod. HASL-300 (10)																						x								
Tritium	Mod. EPA 906.0 (7)																						x			x					
Soil Tests																															
Grain Size	ASTM D442						x																								
Soil Compaction	ASTM D698						x																								
Specific Gravity	ASTM D854						x									x															
Specific Gravity	ASTM D 1298							x								x															
Moisture Content	ASTM D2216			x	x		x			x						x															
Moisture Content	SM 2540G							x		x																					
Soil Permeability	ASTM D2434						x																								
Soil Classification	ASTM D2487/2488						x																								
Atterburg Limits	ASTM D4318						x																								
Hydraulic Conductivity	ASTM D5084						x																								
Toxicology																															
Freshwater Whole Effluent Toxicity	ceriodaphnia & promelas pimephales																														x
Saltwater Whole Effluent Toxicity	Sheepshead minnow & mysids																														x
INORGANIC FRACTIONS																															
General Chemistry																															

Analytical Fraction	Methods	STL AASG (Denver)	STL Anchorage	STL Austin	STL Baltimore	STL Buffalo	STL Burlington	STL Chicago	STL Connecticut	STL Corpus Christi	STL Denver	STL Edison	STL Houston	STL Knoxville	STL Los Angeles	STL Miami	STL Mobile	STL Newburgh	STL North Canton	STL On-Site Technologies	STL Pensacola	STL Pittsburgh	STL Richland	STL Sacramento	STL Savannah	STL St. Louis	STL Tallahassee	STL Tampa East	STL Tampa West	STL Valparaiso	STL Westfield & STL Billerica+
Acidity	EPA 305.1				X	X		X	X	X	X	X	X			X	X				X				X	X	X		X	X	
Acidity	EPA 305.2				X		X				X					X	X							X	X		X		X		X
Acidity	SM18 2310B				X			X				X				X	X				X				X		X		X		
Alkalinity, Hydroxide	EPA 310.1 / SM 2320B			X	X		X	X		X	X				X	X	X		X					X	X		X		X	X	
Alkalinity, Total	EPA 310.1			X	X	X	X	X	X	X	X	X	X		X	X	X		X		X	X		X	X	X	X	X	X	X	
Alkalinity, Total	EPA 310.2					X																									
Alkalinity, Total	SM18 B 2320B			X	X		X	X		X	X	X			X	X	X	X	X		X			X	X		X		X	X	X
Alkalinity, Bicarbonate	EPA 310.1			X	X	X	X	X	X	X	X				X	X	X		X		X	X		X	X	X	X	X	X	X	
Alkalinity, Bicarbonate	SM 406C				X				X		X					X	X								X		X		X		
Alkalinity, Bicarbonate	SM18 B 2320B				X			X		X	X	X			X	X	X	X	X					X	X		X		X	X	
Alkalinity, Carbonate	EPA 310.1			X	X	X	X	X	X	X	X				X	X	X		X		X	X		X	X	X	X	X	X	X	
Alkalinity, Carbonate	SM18 B 2320B			X	X			X		X	X	X			X	X	X	X	X					X	X		X		X	X	
Anion Exchange Capacity	SW 9080								X																X		X				
Anions, by IC (Br, PO_4, SO_4, NO_3, Cl, F)	EPA 300.1 / SW 9056				X	X					X			X		X			X						X		X			X	
Anions, by IC (Br, PO_4, SO_4, NO_3, NO_2,Cl, F)	EPA 300.0 / SW9056			X	X	X	X	X		X	X			X		X		X	X					X	X	X	X	X		X	
Anions, by IC (Br, PO_4, SO_4, NO_3, NO_2, Cl)	SM 4110B				X	X		X							X										X		X				
AOX	1631																							X	X						
Ash	ASTM D-482					X		X		X							X								X	X	X		X	X	
Ash	SM 2540G							X		X						X	X								X		X		X	X	
Ash	ASTM D-3174							X								X	X								X		X		X		
ASTM Leaching Procedure	ASTM D3987				X	X			X			X					X		X			X			X		X		X	X	
BOD5	EPA 405.1				X	X	X	X	X	X	X	X				X	X	X	X		X	X		X	X	X	X	X	X	X	X
BOD5	SM18 5210B				X		X	X		X	X	X			X	X	X	X	X		X	X		X	X		X		X	X	X
CBOD5	SM18 5210B				X	X	X	X		X	X					X	X	X	X		X	X		X	X		X	X	X	X	X
Bomb, Prep for Hazardous Waste	SW 5050						X	X								X									X						
Bottom Sediment & Water	ASTM D-4007							X																						X	
Bromide	SW 320.1					X			X							X	X														
Bromide	Method 300.0					X																		X							
BTU	ASTMD 240-87					X	X									X		X							X	X					
Cation Exchange Capacity	SW 9080			X					X	X															X						

Analytical Fraction	Methods	STL AASG (Denver)	STL Anchorage	STL Austin	STL Baltimore	STL Buffalo	STL Burlington	STL Chicago	STL Connecticut	STL Corpus Christi	STL Denver	STL Edison	STL Houston	STL Knoxville	STL Los Angeles	STL Miami	STL Mobile	STL Newburgh	STL North Canton	STL On-Site Technologies	STL Pensacola	STL Pittsburgh	STL Richland	STL Sacramento	STL Savannah	STL St. Louis	STL Tallahassee	STL Tampa East	STL Tampa West	STL Valparaiso	STL Westfield & STL Billerica*
Cation Exchange Capacity	SW 9081			X	X		X	X				X							X					X	X						
Chloride	EPA 300			X		X				X	X			X	X	X			X					X	X			X		X	
Chloride	EPA 325.2				X	X	X	X	X	X	X						X		X			X		X	X		X	X		X	
Chloride	EPA 325.3				X						X		X						X		X			X	X	X			X		X
Chloride	SW 9250						X				X					X			X		X			X	X	X				X	
Chloride	SW 9251				X	X		X			X						X		X			X			X		X	X		X	
Chloride	SW 9252A												X						X		X				X				X		X
Chloride	SW 9253									X		X				X															
Chloride	SM18 4500-CL B			X								X				X		X												X	
Chloride	SM18 4500-Cl C																				X				X				X	X	X
Chloride	SM18 4500-Cl E				X		X	X									X								X		X			X	
Chloride (Emissions)	SW 9057/Method 26a			X																											
Chlorine (O2 Bomb)	SW 5050 (followed by Cl Analysis)			X			X	X								X									X	X				
Chlorine Demand	SM 2350B					X			X			X																		X	
Chlorine Residual	EPA 330.4				X	X		X	X	X		X	X			X								X						X	
Chlorine Residual	EPA 330.5											X				X			X		X									X	
Chlorine Residual	SM18 4500Cl F				X			X				X																			
Chlorine Residual	SM18 4500Cl G						X											X			X										
COD	EPA 410.1						X									X	X								X	X	X	X	X		
COD	EPA 410.4			X	X	X			X		X	X	X			X		X	X		X	X		X		X		X		X	X
COD	SM18 5220B						X																								
COD	SM185520C																											X			
COD	SM18 5220D			X			X					X			X				X		X			X							X
COD	Hach 8000					X		X		X								X						X						X	X
Coliform, Fecal	SM18 9222-D									X						X	X	X			X				X		X		X	X	X
Coliform, Fecal	(DW) SM18 9223 UV+(ONPG-MUG)															X					X						X				
Coliform, Strep	SM18 9230-C-a															X															X
Coliform, Total	SM18 9222-B									X						X	X	X			X				X		X		X	X	X
Coliform, Total	(DW) SM18 9223 (ONPG-MUG)															X		X			X						X			X	
Color	EPA 110.1						X				X					X															

SEVERN TRENT LABORATORIES

Analytical Fraction	Methods	STL AASG (Denver)	STL Anchorage	STL Austin	STL Baltimore	STL Buffalo	STL Burlington	STL Chicago	STL Connecticut	STL Corpus Christi	STL Denver	STL Edison	STL Houston	STL Knoxville	STL Los Angeles	STL Miami	STL Mobile	STL Newburgh	STL North Canton	STL On-Site Technologies	STL Pensacola	STL Pittsburgh	STL Richland	STL Sacramento	STL Savannah	STL St. Louis	STL Tallahassee	STL Tampa East	STL Tampa West	STL Valparaiso	STL Westfield & STL Billerica+
Color	EPA 110.2				x	x		x	x	x	x	x	x			x	x				x				x	x	x	x	x	
Color (Spectrophotometric)	EPA 110.3												x																		
Color	SM18 2120B				x			x			x	x					x	x			x				x		x		x	x
Corrosivity, as pH	SW 9040B, SW 9045C			x	x	x	x	x	x	x	x	x		x	x		x	x	x		x	x		x	x	x	x	x	x	x
Corrosivity (NACE)	SW 1110									x							x		x		x										
Conductance, Specific	EPA 120.1/SW 9050A/SM18 2510B			x	x	x	x	x	x	x	x	x	x		x	x	x	x	x		x	x		x	x	x	x	x	x	x	x
Corrosivity (Langlier Index)	SM 2330A+B							x								x	x	x							x		x		x	x	
Chromium, Trivalent	Total Cr - Cr+6			x	x			x	x	x	x						x								x		x		x	x	
Chromium (Hexavalent)	SW 7196A			x	x	x	x	x	x	x	x	x	x		x		x		x		x	x		x	x	x	x	x	x	x	x
Chromium (Hexavalent)	SM 3500D				x		x	x			x					x	x	x	x			x		x	x		x		x	x	x
Chromium (Hexavalent)	USGS I1230-85-01032											x																			
Chromium (Hexavalent, in Soil)	SW 3060A / 7196A (NJ Mod)						x			x		x				x															
Chromium (Hexavalent, in Soil)	1005				x			x								x									x						
Chromium (Hexavalent)	SW 7195					x																									
Chromium (Hexavalent, Emissions)	SW 0061/SW 7199			x																											
CTAS	SM5540																x														
Cyanide, Amenable to Chlorination	EPA 335.1			x	x	x	x	x	x	x	x		x	x		x	x		x		x			x	x	x					
Cyanide, Amenable to Chlorination	SM18 4500-CN G						x	x		x	x						x	x			x				x					x	
Cyanide, Amenable to Chlorination	SW 9010B / 9014					x		x			x										x				x						
Cyanide, Amenable to Chlorination	SW 9012A			x	x				x		x	x	x	x			x		x			x		x	x	x				x	
Cyanide, Amenable to Chlorination	Lachat 204001A															x	x							x						x	x
Cyanide, Extractable	SW 9013								x		x										x			x	x						
Cyanide, Total (Colorimetric)	EPA 335.2				x	x		x		x	x	x	x		x	x	x	x	x					x	x	x		x			x
Cyanide, Total	ILM04.0				x	x	x	x	x			x		x				x	x		x	x			x	x					
Cyanide, Total (Automated)	EPA 335.3			x	x				x		x	x				x			x		x	x			x						
Cyanide, Total	EPA 335.4				x		x		x		x	x		x		x	x		x		x				x						
Cyanide, Total (prep only)	SW 9010B							x		x	x				x	x	x				x			x	x			x		x	x
Cyanide, Total	SW 9012A			x	x		x		x		x	x	x	x	x	x	x		x			x		x	x	x					x
Cyanide, Total	SW 9010B / SW 9014					x		x		x	x					x		x			x			x	x			x			x
Cyanide, Total	SM4500-CN.A-E				x		x				x	x				x	x	x	x						x					x	x

Analytical Fraction	Methods	STL AASG (Denver)	STL Anchorage	STL Austin	STL Baltimore	STL Buffalo	STL Burlington	STL Chicago	STL Connecticut	STL Corpus Christi	STL Denver	STL Edison	STL Houston	STL Knoxville	STL Los Angeles	STL Miami	STL Mobile	STL Newburgh	STL North Canton	STL On-Site Technologies	STL Pensacola	STL Pittsburgh	STL Richland	STL Sacramento	STL Savannah	STL St. Louis	STL Tallahassee	STL Tampa East	STL Tampa West	STL Valparaiso	STL Westfield & STL Billerica+
Cyanide, Total	SM 4500 CNC E							x			x					x	x		x						x	x				x	
Cyanide, Total	SM 4500 CN G										x																				
Cyanide, Free	EPA 335.2												x																		
Cyanide, Free	SM 18 4500-CN I					x			x	x	x							x	x		x	x		x	x			x		x	
Cyanide, Free	Lachat 204001A																														x
Cyanide, Free	SM4500-CN.A-E										x					x									x					x	x
Cyanide, Physiologically Available CN	MA DEP								x																						x
Cyanide, Weak & Dissociable	SM.4500CN I				x			x		x	x					x		x				x			x					x	
Density	SM18 2710F						x	x									x								x		x		x		
Density	ASTM D1298							x		x						x	x								x		x		x		
Density	ASTM 5057							x																						x	
Dissolved Inorganic Carbon	EPA 415.1 M				x		x	x			x						x								x		x	x			
Dissolved Organic Carbon	EPA 415.1				x		x	x			x				x	x	x								x		x	x		x	
Dissolved Oxygen	EPA 360.1				x	x							x											x		x		x			
Extractable Organic Halides (EOX)	SW 9020B									x	x					x		x							x						
Extractable Organic Halides (EOX)	SW 9023					x				x	x	x													x	x					
Ferrous Iron	SM18 3500B					x			x									x													x
Ferrous Iron	SM19 3500FE-D				x	x	x	x			x	x				x	x	x	x						x		x		x		
Flashpoint	SW 1010				x	x	x	x	x	x	x				x	x		x	x		x	x			x	x		x		x	x
Flashpoint	SW 1020A		x	x								x				x								x		x					
Flashpoint	SW 1030								x			x					x								x		x		x		
Flashpoint	ASTM D-92							x		x						x									x		x			x	
Flashpoint	ASTM D-93							x			x					x			x											x	
Fluoride (probe)	EPA 340.2			x	x	x	x	x	x	x	x	x	x		x		x	x	x		x	x		x	x		x	x	x	x	
Fluoride (probe)	SM18 4500-F C				x		x	x		xx	x	x				x	x		x		x				x	x	x		x		x
Fluoride (distillation probe)	EPA 340.2 / SM18 4500-F C				x			x								x					x					x					
Fluoride (distillation probe)	SW 9214											x									x										
Fl Fluoride (IC)	EPA 300			x		x					x			x		x			x					x	x	x	x	x		x	
Fluorine	SW 5050 (followed by F analysis)							x																	x						
Formaldehyde	NYSDOH APC-44								x																						

Analytical Fraction	Methods	STL AASG (Denver)	STL Anchorage	STL Austin	STL Baltimore	STL Buffalo	STL Burlington	STL Chicago	STL Connecticut	STL Corpus Christi	STL Denver	STL Edison	STL Houston	STL Knoxville	STL Los Angeles	STL Miami	STL Mobile	STL Newburgh	STL North Canton	STL On-Site Technologies	STL Pensacola	STL Pittsburgh	STL Richland	STL Sacramento	STL Savannah	STL St. Louis	STL Tallahassee	STL Tampa East	STL Tampa West	STL Valparaiso	STL Westfield & STL Billerica+
Formaldehyde	NIOSH 3500Mod.											x				x												x			
Free Carbon Dioxide	SM 4500 CO2D							x			x						x									x		x		x		
Glycol	NYSDOH APC-44								x																							
Hardness (EDTA Total as CaCO3)	EPA 130.2			x	x	x	x	x		x	x	x	x			x	x	x	x			x		x	x	x	x	x	x		
Hardness (EDTA Total as CaCO3)	SM18 2340B						x	x	x		x	x		x			x		x			x		x	x		x		x		x
Hardness (EDTA Total as CaCO3)	SM19 2340C			x	x		x	x				x					x					x		x	x		x	x	x		
Hardness (calculation)	EPA 200.7 / SW 6010B			x		x	x	x	x		x	x		x	x	x	x	x	x		x	x		x	x		x	x	x		
Heavy Metals	USP, 22 Ed 231, Md. II							x																								
Hydrazine	ASTMD1385																											x				
Ignitability	SW 1010				x	x	x	x	x	x	x					x		x	x		x			x	x	x				x	x
Ignitability	SW 1020A		x	x								x				x										x					
Ignitability	SW 1030								x								x								x		x		x		
Ignitability	ASTM D-4982A							x																								
Ignitability	SW Sec. 7				x			x			x					x			x			x			x			x			
MBAS, Surfactants	EPA 425.1				x	x	x	x	x	x			x			x	x	x			x			x	x	x	x	x	x		
MBAS, Surfactants	SM18 5540C				x		x	x							x	x	x	x			x				x		x		x		
Moisture, Percent (%)	EPA 160.3			x	x	x	x		x	x	x	x	x		x	x	x	x	x		x	x		x	x	x	x	x	x	x	x
Moisture, Percent (%)	SM 2540G M							x		x	x						x		x						x		x		x	x		
Ammonia, Nitrogen	EPA 350.1			x	x	x					x	x				x	x		x		x	x			x	x	x			x		
Ammonia, Nitrogen / Distillation	EPA 350.1			x							x								x			x			x					x		
Ammonia, Nitrogen / Distillation	EPA 350.2						x	x				x				x					x							x		x		
Ammonia, Nitrogen / Distillation	EPA 350.3								x	x			x		x	x			x					x				x				
Ammonia, Nitrogen / Distillation	SM 4500 NH3B+C							x																								
Ammonia, Nitrogen / Distillation	SM18 4500-NH_3 E															x		x			x									x		
Ammonia, Nitrogen / Distillation	SM18 4500-NH_3 H				x							x			x	x														x	x	
Ammonia, Unionized	FL DEP SOP																											x				
Nitrate-Nitrogen	EPA 300			x		x					x			x	x	x			x					x	x		x	x		x		
Nitrate-Nitrogen	353.2, SM18 4500NO_3F			x	x	x	x	x		x	x	x	x				x				x	x			x	x	x		x	x		
Nitrate-Nitrogen	Lachat 107041A																x	x						x	x		x		x			x
Nitrite-Nitrogen	EPA 300			x		x					x			x	x	x			x					x	x	x	x	x		x		

Analytical Fraction	Methods	STL AASG (Denver)	STL Anchorage	STL Austin	STL Baltimore	STL Buffalo	STL Burlington	STL Chicago	STL Connecticut	STL Corpus Christi	STL Denver	STL Edison	STL Houston	STL Knoxville	STL Los Angeles	STL Miami	STL Mobile	STL Newburgh	STL North Canton	STL On-Site Technologies	STL Pensacola	STL Pittsburgh	STL Richland	STL Sacramento	STL Savannah	STL St. Louis	STL Tallahassee	STL Tampa East	STL Tampa West	STL Valparaiso	STL Westfield & STL Billerica+
Nitrite-Nitrogen	EPA 353.2			X	X	X	X	X	X	X	X	X	X				X		X		X	X		X	X	X	X	X	X	X	
Nitrite-Nitrogen	EPA 354.1						X	X			X		X						X		X								X		
Nitrite-Nitrogen	SM18 4500NO_2B				X		X	X			X										X								X		X
Nitrate/Nitrite	EPA 300			X		X					X				X	X			X					X	X			X		X	
Nitrate/Nitrite	EPA 353.2			X	X	X	X	X	X		X	X	X				X		X		X	X		X	X	X	X	X	X	X	
Nitrate/Nitrite	SM18 4500NO_3F						X	X			X	X					X	X			X				X		X		X	X	
Nitrate/Nitrite	Lachat 107041A																X							X	X		X		X		X
Nitrogen, Total Kjeldahl (TKN)	EPA 351.2			X	X	X	X		X	X	X	X	X			X	X	X			X			X	X		X			X	
Nitrogen, Total Kjeldahl (TKN)	EPA 351.3 / SM18 4500-NH_3E						X			X						X			X		X							X		X	
Nitrogen, Total Kjeldahl (TKN)	EPA 351.3 / SM18 4500-NH_3E															X			X		X									X	
Nitrogen, Total Kjeldahl (TKN)	EPA 351.3 / SM18 4500NorgC							X								X														X	
Nitrogen, Total Kjeldahl (TKN)	Lachat 107062D																X								X		X				X
Nitrogen, Total Organic (TON)	EPA 351.2				X				X		X	X					X								X		X			X	
Nitrogen, Total Organic (TON)	EPA 350.1, EPA 351.2					X					X	X				X	X								X		X			X	
Nitrogen, Total Organic (TON)	EPA 350.1, EPA 351.3						X				X					X		X			X										
Nitrogen, Total Organic (TON)	EPA 351.3 / EPA 350.2							X			X					X			X							X		X			
Nitrogen, Total Organic (TON)	SM 4500NorgC / 4500NH3B+C							X			X																				
Nitrogen, Total	EPA 351.3/353.2																							X				X			
Odor	EPA 140.1					X		X	X	X						X	X				X				X		X		X		
Odor	SM 2150B							X									X								X		X		X		X
Oil & Grease (IR)	EPA 413.2			X	X		X	X	X			X			X	X	X		X		X	X			X		X		X	X	
Oil & Grease (Gravimetric)	EPA 413.1				X	X	X	X	X	X		X	X		X	X		X	X		X	X				X				X	
Oil & Grease (Gravimetric)	SW 9070				X	X	X	X				X	X			X			X		X					X				X	
Oil & Grease (Gravimetric)	SW 9071A				X	X	X	X				X	X			X			X		X					X				X	
Oil & Grease (Gravimetric)	SM18 5520B				X			X								X			X		X									X	
Oil & Grease (IR-Waters)	SW 5520C							X									X		X											X	
Oil & Grease (Gravimetric-Soxhlet)	SW 5520D							X																						X	
Oil & Grease	1664			X	X	X			X		X		X	X		X	X		X					X	X		X		X	X	
Oxidation / Redox Potential	SM18 2580				X							X													X						
Oxidation / Redox Potential	ASTM D1498				X		X	X	X	X															X						X

SEVERN TRENT LABORATORIES

Analytical Fraction	Methods	STL AASG (Denver)	STL Anchorage	STL Austin	STL Baltimore	STL Buffalo	STL Burlington	STL Chicago	STL Connecticut	STL Corpus Christi	STL Denver	STL Edison	STL Houston	STL Knoxville	STL Los Angeles	STL Miami	STL Mobile	STL Newburgh	STL North Canton	STL On-Site Technologies	STL Pensacola	STL Pittsburgh	STL Richland	STL Sacramento	STL Savannah	STL St. Louis	STL Tallahassee	STL Tampa East	STL Tampa West	STL Valparaiso	STL Westfield & STL Billerica+
Oxygen, Dissolved	EPA 360.1				x	x		x			x	x				x	x				x	x		x	x		x	x	x		
Oxygen, Dissolved	EPA 360.2				x		x	x								x	x		x					x	x		x		x		
Oxygen, Dissolved	SM18 4500-O C				x		x	x	x		x					x	x	x			x				x		x		x	x	x
Oxygen, Dissolved	SM18 4500-O G				x			x				x				x	x								x		x		x		
Paint Filter Test	SW 9095A			x	x	x	x	x	x	x	x	x				x	x	x			x	x		x	x	x	x	x	x	x	x
Petroleum Hydrocarbons-IR (TPHC)	EPA 418.1			x	x	x	x	x	x	x		x	x			x	x	x	x	x	x	x		x	x		x	x	x	x	
Petroleum Hydrocarbons-IR (TPHC)	SW 9073					x										x	x				x				x		x		x		
Petroleum Hydrocarbons (TPHC)	NYSDOH 310.13					x												x													
Petroleum Hydrocarbons (Gravimetric)	SM18 5520 F				x				x										x											x	
PH	EPA 150.1 / SW 9040B / 9045C/ 4500H+B			X	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x		x	x		x	x	x	x	x	x	x	x
pH	SW 9041A							x			x	x				x	x		x						x		x		x		
Phenols, Total	EPA 420.1				x		x			x	x					x	x	x	x		x				x					x	x
Phenols, Total	EPA 420.2			x		x		x	x		x	x	x			x						x		x		x		x			
Phenols, Total	SW 9065				x		x			x	x					x	x		x		x			x	x						x
Phenols, Total	SW 9066			x		x		x	x		x	x	x			x						x				x		x		x	
Phenols, Total	SM18 5530C						x				x													x							x
Phosphate (Ortho)	EPA 365.2			x		x	x	x	x	x	x	x				x	x		x		x				x		x		x	x	
Phosphate (Ortho)	EPA 365.3				x						x		x			x		x	x					x						x	
Phosphate (Ortho)	SW 9056										x						x								x							
Phosphate (Ortho)	EPA 365.4																x								x		x	x			
Phosphate (Ortho)	EPA 300										x			x	x	x			x						x			x		x	
Phosphate (Ortho)	SM18 4500-P E						x	x	x		x	x					x				x				x		x		x	x	x
Phosphorus (Total)	EPA 365.1						x									x					x	x				x		x			
Phosphorus (Total)	EPA 365.2			x		x		x	x			x				x								x						x	
Phosphorus (Total)	EPA 365.3				x						x		x					x	x												
Phosphorus (Total)	SM18 4500-P BE						x					x									x			x						x	x
Phosphorus (Total)	SM18 4500-P E							x																						x	
Purgeable Organo Halides (POX)	9021										x																				
Reactivity (Cyanide/Sulfide)	SW846,Chapter7			x	x	x	x	x	x	x	x	x	x			x	x		x		x				x	x				x	x

Analytical Fraction	Methods	STL AASG (Denver)	STL Anchorage	STL Austin	STL Baltimore	STL Buffalo	STL Burlington	STL Chicago	STL Connecticut	STL Corpus Christi	STL Denver	STL Edison	STL Houston	STL Knoxville	STL Los Angeles	STL Miami	STL Mobile	STL Newburgh	STL North Canton	STL On-Site Technologies	STL Pensacola	STL Pittsburgh	STL Richland	STL Sacramento	STL Savannah	STL St. Louis	STL Tallahassee	STL Tampa East	STL Tampa West	STL Valparaiso	STL Westfield & STL Billerica+
Salinity	SM18 2520B						x	x	x															x						x
Salinity	SM17 201C																			x				x						
Silica	EPA 370.1				x	x			x	x						x									x					
Silica	SW 6010B (Mod)						x	x			x			x		x					x		x	x						
Silica	SM 4500-Si-D								x							x														
Sludge Volume Index	SM 2710 D								x																					x	
Solids, Percent	SM 2540G							x		x	x						x								x		x		x		x
Solids, Percent	EPA 160.3 MOD																							x				x			
Solids, Settleable	EPA 160.5				x	x	x	x	x	x	x	x	x			x	x	x	x		x	x		x	x	x	x		x		
Solids, Settleable	SM18 2540F				x		x	x	x	x	x	x					x	x			x				x		x		x		x
Solids, Total	EPA 160.3			x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x		x	x		x	x	x	x	x	x	x	
Solids, Total	SM18 2540 B			x	x		x	x		x	x	x					x	x			x				x		x		x	x	x
Solids, Total Fixed & Volatile	SM19 2540G					x	x			x	x	x					x	x							x		x		x	x	
Solids, Total Fixed & Volatile	SM18 2540G							x		x	x						x	x							x		x		x	x	x
Solids, Total Dissolved	EPA 160.1			x	x	x	x	x	x	x	x	x	x		x	x	x	x	x		x	x		x	x	x	x	x	x	x	x
Solids, Total Dissolved	SM18 2540 C				x		x	x		x	x	x					x	x			x				x		x		x	x	x
Solids, Total Suspended	EPA 160.2			x	x	x	x	x	x	x	x	x	x		x	x	x	x	x		x	x		x	x	x	x	x	x	x	x
Solids, Total Suspended	SM18 2540 D				x		x	x		x	x	x					x	x			x				x		x		x	x	x
Solids, Total Volatile	EPA 160.4 SM 18 2540 E				x	x	x	x	x	x	x	x					x	x	x		x	x			x		x		x	x	x
Solids, Volatile Suspended	EPA 160.4 SM 18 2540 E				x		x	x	x	x	x	x	x				x	x			x				x		x		x	x	x
Specific Gravity	SM18 2710 F			x		x	x	x			x						x		x						x		x	x		x	
Specific Gravity	ASTM D-1298							x		x	x					x	x							x	x		x				
Sulfate, as SO_4	EPA 300			x		x				x	x			x	x	x			x					x	x	x	x	x			
Sulfate, as SO_4	EPA 375.2								x							x														x	
Sulfate, as SO_4	EPA 375.4			x	x	x	x	x		x	x	x	x				x	x			x	x		x	x	x	x	x		x	x
Sulfate, as SO_4	SW 9038			x	x	x	x	x		x	x	x	x				x				x				x		x	x		x	
Sulfate, as SO_4	SM 4500-$SO_4$2.A-E						x											x												x	x
Sulfate, as SO_4	SM 4500-$SO_4$2 E							x									x								x		x			x	
Sulfide, as S	EPA 376.1			x	x	x	x	x	x			x	x			x	x		x		x	x		x	x	x		x		x	x
Sulfide, as S	EPA 376.2			x			x			x	x					x	x								x					x	

SEVERN TRENT LABORATORIES

Analytical Fraction	Methods	STL AASG (Denver)	STL Anchorage	STL Austin	STL Baltimore	STL Buffalo	STL Burlington	STL Chicago	STL Connecticut	STL Corpus Christi	STL Denver	STL Edison	STL Houston	STL Knoxville	STL Los Angeles	STL Miami	STL Mobile	STL Newburgh	STL North Canton	STL On-Site Technologies	STL Pensacola	STL Pittsburgh	STL Richland	STL Sacramento	STL Savannah	STL St. Louis	STL Tallahassee	STL Tampa East	STL Tampa West	STL Valparaiso	STL Westfield & STL Billerica+
Sulfide, as S	SM18 4500-S2.A-E						X										X				X				X					X	X
Sulfide, as S	SM18 4500-S2 E				X			X									X								X					X	
Sulfide, as S (Distillation)	SW 9030B						X		X		X	X	X				X				X	X		X	X	X				X	
Sulfide, Acid Soluble	SW 9030B/9034			X		X	X	X		X	X	X					X				X				X						
Sulfide, Acid Insoluble	SW 9030B/9034					X	X			X											X										
Sulfite, as SO_3	EPA 377.1 SM18 4500-SO_3 B				X	X	X			X	X	X	X				X	X			X				X		X		X	X	
Sulfur	SW 5050 (Followed by SO4 Analysis)							X								X									X						
Total Carbon	EPA 415.1 M							X			X					X	X								X	X	X	X		X	
Total Inorganic Carbon	EPA 415.1 M / SM 5310C M				X			X			X					X	X		X						X	X	X	X		X	
Total Organic Carbon (TOC)	EPA 415.1			X	X	X	X	X			X	X	X		X	X	X		X					X	X		X	X		X	
Total Organic Carbon (TOC)	EPA 415.2								X							X					X					X					
Total Organic Carbon (TOC)	SM18 5310 B											X					X				X				X		X				
Total Organic Carbon (TOC)	SM18 5310 C							X																							
Total Organic Carbon (TOC)	SW 9060			X	X	X	X	X			X	X	X		X	X	X							X	X	X	X	X			
Total Organic Carbon (TOC)	Lloyd Kahn (Region II)			X	X		X		X			X																			
Total Organic Carbon (TOC)	Walkley Black				X			X		X			X						X		X	X		X	X						
Total Organic Halides (TOX)	EPA 450.1					X	X										X		X					X	X	X					
Total Organic Halides (TOX)	SW 9020B					X	X	X		X	X	X	X				X		X		X			X	X	X					
Total Organic Halides (TOX)	SW 5050/9253																				X										
Total Organic Halides (TOX)	SM18 5320B							X				X					X								X						
Total Organic Halides (TOX) (Waste)	Cl2 - Cl							X									X								X						
Total Organic Halides (TOX) (AOX)	1650										X						X							X	X						
Turbidity	EPA 180.1 SM18 2130 B				X	X	X	X	X	X	X	X	X		X	X	X	X	X		X			X	X	X	X	X	X	X	X
Unionized Hydrogen Sulfide	SM4500 S-F																					X									
Viscosity, Brookfield	ASTM D-2196					X		X																							
Viscosity, Kinematic	ASTM D-445							X																							
Volatiles, Percent	SM 2540G							X		X	X																				
Water, Percent (Dean Stark)	ASTM D95							X																							
Water, Percent (Karl Fischer)	ASTM D4377							X		X																					

Analytical Fraction	Methods	STL AASG (Denver)	STL Anchorage	STL Austin	STL Baltimore	STL Buffalo	STL Burlington	STL Chicago	STL Connecticut	STL Corpus Christi	STL Denver	STL Edison	STL Houston	STL Knoxville	STL Los Angeles	STL Miami	STL Mobile	STL Newburgh	STL North Canton	STL On-Site Technologies	STL Pensacola	STL Pittsburgh	STL Richland	STL Sacramento	STL Savannah	STL St. Louis	STL Tallahassee	STL Tampa East	STL Tampa West	STL Valparaiso	STL Westfield & STL Billerica+
OTHER SERVICES																														
Field Services						X	X					X		X		X	X	X	X	X	X				X		X	X	X	X	X
Diskette Deliverables		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X
Mobile Laboratory						X								X	X					X											X
Quality Assurance Plan Writing/Review				X	X		X	X			X			X	X		X		X	X		X			X		X	X	X	X	
Report Deliverables														X																	
Level 1 - Data Summary		X	X	X	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X
Level 2 - w/ QC		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X
Level 3 - Reduced Format		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X		X	X	X		X	X	X	X	X		X	X
Level 4 - Full/CLP				X	X	X	X	X	X		X	X	X	X	X			X	X	X	X	X		X	X	X	X	X			X

+ All analyses conducted at STL Westfield with the exception of Microscopy Services
* Only as Methanol Preserved
****Exception to Forms.
(1) Lab must be notified in advance
(2) Method for determination of Volatile Petroleum Hydrocarbons, MADEP-VPH-98-1, Revision 0, January 1998
(3) Method for Determination of Petroleum Range Organics, FL DEP.
(4) Method for the Determination of Extractable Petroleum Hydrocarbons, By GC/FID, Tennessee DEC.
(5) Method for the Determination of Extractable Petroleum Hydrocarbons, MADEP-EPH-98-1, Revision 0, January 1998.
(6) Methods from EPA / 625 / R-96/101b, Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air
(7) Methods reference EPA-600/4/80-032, Prescribed Procedures for Measurement for Radioactivity in Drinking Water, Aug. 1990.
(8) Methods reference EPA-600/4/75-001, Prescribed Procedures for Measurement for Radioactivity in Drinking Water, Aug. 1990.
(9) Methods Compendium
(10) Methods from Environmental Measurements Laboratory (EML) Procedures Manual, 27th Edition, November 1990.
SM16 = Standard Methods for the Examination of Water and Wastewater, 16th Edition
SM17 = Standard Methods for the Examination of Water and Wastewater, 17th Edition
SM18 = Standard Methods for the Examination of Water and Wastewater, 18th Edition

SEVERN TRENT LABORATORIES

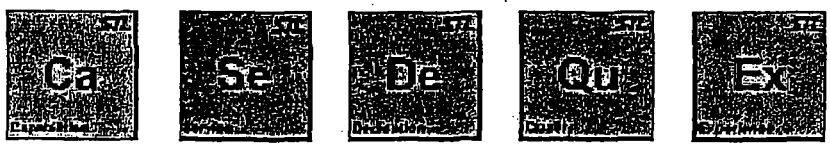
SM19 = Standard Methods for the Examination of Water and Wastewater, 19th Edition
SW = USEPA Test Methods for Evaluating Solid Wastes, SW-846, 3rd Edition
ASTM = American Society for Testing & Materials

SEVERN TRENT SERVICES

SEVERN TRENT LABORATORIES

APPENDIX B

Certifications



Certifying State/Program	Program Type	STL Anchorage	STL Austin	STL Baltimore	STL Billerica	STL Buffalo	STL Burlington	STL Chicago	STL Connecticut	STL Corpus Christi	STL Denver	STL Edison	STL Houston	STL Knoxville	STL Los Angeles	STL Miami	STL Mobile	STL Newburgh	STL North Canton	STL Pensacola	STL Pittsburgh	STL Richland	STL St. Louis	STL Sacramento	STL Savannah	STL Tallahassee	STL Tampa East	STL Tampa West	STL Valparaiso	STL Westfield
Alabama	DW			X				X			X					X	X		X	X	x					X	X			
	MICRO																X													
Alaska	DW																													
	UST	X		IP							X				X															
Arizona	DW-Asbestos				X																									
	DW					X		X			X				X									X						
	WW					X		X			X				X					X				X						
	HW					X		X			X				X					X				X						
	Air														X									X						
	Radiological																													
Arkansas	DW					X		X			X																			
	WW		X			X		X			X			X		X				X			IP	X	X					
	HW		X			X		X			X			X		X				X			IP	X	X					
	MICRO																													
	Soil		X			X		X			X			X		X				X			IP	X	X					
California	DW						X	X						X	X									X						
	WW		X	X		X	X	X			X		X	X	X				X	X			X	X						
	HW		X	X		X	X	X			X		X	X	X				X	X			X	X						
	Radiological																					X	X							
Colorado	DW-Asbestos				X																									
	DW			X				X		IP	X				X						X	X								
Connecticut	General			X		X	X	X	X		X	X		X		X		X	X	X	X		X	X			X			X

Certifying State/Program	Program Type	STL Anchorage	STL Austin	STL Baltimore	STL Billerica	STL Buffalo	STL Burlington	STL Chicago	STL Connecticut	STL Corpus Christi	STL Denver	STL Edison	STL Houston	STL Knoxville	STL Los Angeles	STL Miami	STL Mobile	STL Newburgh	STL North Canton	STL Pensacola	STL Pittsburgh	STL Richland	STL St. Louis	STL Sacramento	STL Savannah	STL Tallahassee	STL Tampa East	STL Tampa West	STL Valparaiso	STL Westfield
	DW					X		X			X	X		X					X		X			X	X					
	DW-Asbestos				X																									
	Asbestos																													
	Radiological																						X							
Delaware	DW			X				X																						
	Superfund DNREC			X							X																			
Florida	DW						X	X						X		X	X			X				X	X	X	X	X		
	WW			X			X	X						X		X	X		X	X	IP			x	X	X	X	X		
	HW			X			X	X			X			X		X	X		X	X	IP			x	X	X	X	X		
	Air														X															
	DW-Asbestos				X																									
Georgia	DW			X				X						X			X								X	X	X			
	MICRO																X								X	X				
Hawaii	DW			X				X						X										x						
	MICRO																													
Idaho	DW-Asbestos				X																									
	DW			X				X			X											X								
Illinois	DW							X															X							
	WW							X																					IP	
	HW							X																					IP	
	MICRO																													
Indiana	DW			X				X						X											X	X			X	
	MICRO																								X					

Certifying State/Program	Program Type	STL Anchorage	STL Austin	STL Baltimore	STL Billerica	STL Buffalo	STL Burlington	STL Chicago	STL Connecticut	STL Corpus Christi	STL Denver	STL Edison	STL Houston	STL Knoxville	STL Los Angeles	STL Miami	STL Mobile	STL Newburgh	STL North Canton	STL Pensacola	STL Pittsburgh	STL Richland	STL St. Louis	STL Sacramento	STL Savannah	STL Tallahassee	STL Tampa East	STL Tampa West	STL Valparaiso	STL Westfield
Iowa	DW							X																	X					
	WW							X																	X					
	UST			X																										
Kansas	DW							X								X														
	WW		X	X		X		X			X					X				X			X		X					
	DW		X	X		X		X			X					X				X			X		X					
	Radiological																													
Kentucky	DW			X		X		X					X	X		X			X	X	X				X		X			
	DW-Asbestos				X																									
	UST			X		x		X					X												X					
Louisiana	DW			X			X	X								X				X					X		P			
	GW/WW/MW		X			X	X	X		P				X	X			X		X				X	X	X				
Maine	DW			X			X		X																		X			
	DW-Asbestos				X																									
	Asbestos																													
Maryland	DW			X		X		X			X			X	X	X			X	X	X			X	X		X			
	DW-Asbestos				X																									
	Radiological																													
Massachusetts	DW			X		X	X	X	X					X		X		X	X		X				X	X	X			X
	WW			X	X	X	X	X	X					x				X	X	X	X				X	X	X			X
	DW-Asbestos				X																									
	Asbestos																													
Michigan	DW			X				X												X					X					

Certifying State/Program	Program Type	STL Anchorage	STL Austin	STL Baltimore	STL Billerica	STL Buffalo	STL Burlington	STL Chicago	STL Connecticut	STL Corpus Christi	STL Denver	STL Edison	STL Houston	STL Knoxville	STL Los Angeles	STL Miami	STL Mobile	STL Newburgh	STL North Canton	STL Pensacola	STL Pittsburgh	STL Richland	STL St. Louis	STL Sacramento	STL Savannah	STL Tallahassee	STL Tampa East	STL Tampa West	STL Valparaiso	STL Westfield
	DW-Asbestos				X																									
Minnesota	DW							X			X								X						X					
	WW					X		X			X								X						X					
	HW					X		X			X								X						X					
Mississippi	DW							X									X													
Missouri	DW							X											X				X							
	MICRO																													
Montana	DW			X				X																						
Nebraska	DW						X	IP																						
Nevada	DW							X						X									X							
	WW							X						X									X							
New Hampshire	DW			X		X	X	X	X												X									X
	WW			X		X	X	X	X											X	X									X
New Jersey	DW		X			X	X	X	X			X		X				X						X						
	DW-Radiological																													
	WW		X	X		X	X	X	X			X	X	X				X	X		X									
	Hazardous Waste		X	X		X	X	X	X			X	X					X	X											
	SUP		X	X			X		X			X																		
New Mexico	DW-Asbestos																													
	DW - Dioxin													X																
New York	DW					X	X	X	X			X		X				X					X	X	X					X
	DW-Radiological																						X							

Certifying State/Program	Program Type	STL Anchorage	STL Austin	STL Baltimore	STL Billerica	STL Buffalo	STL Burlington	STL Chicago	STL Connecticut	STL Corpus Christi	STL Denver	STL Edison	STL Houston	STL Knoxville	STL Los Angeles	STL Miami	STL Mobile	STL Newburgh	STL North Canton	STL Pensacola	STL Pittsburgh	STL Richland	STL St. Louis	STL Sacramento	STL Savannah	STL Tallahassee	STL Tampa East	STL Tampa West	STL Valparaiso	STL Westfield
	WW		X	X		X	X	X	X			X		X				X	X	X	X		X		X					X
	WW-Radiological																						X							
	HW		X	X		X	X	X	X			X		X				X	X	X	X		X		X					X
	CLP			X		X	X		X			X						X	X		X									
	Air Emissions		X			X	X		X					X																
	DW-Asbestos		X		X																									
	Asbestos																													
North Carolina	DW					X		X											X						X	X				
	DW-Radiological																													
	DW-Asbestos				X																									
	WW/LC		X	X		X		X	X		X			X		X	X			X	X				X	X	X			
North Dakota	DW-Asbestos																													
	DW					X		X																X	X					
	HW					X		X			X			X					X	X				X						
	WW		X	X		X		X			X								X	X				X						
Ohio	VAP							X						X					X		IP									
Oklahoma	WW		X			X		X			X		X	X		X			X	X										
	DW							X																						
	HW		X			X		X			X		X	X		X			X	X										
Oregon																						X		X						
Pennsylvania	DW		X	X		X	X	X				X						X	X	X	X				X	X				
	DW-Radiological																													
	DW-Asbestos				X																									

Certifying State/Program	Program Type	STL Anchorage	STL Austin	STL Baltimore	STL Billerica	STL Buffalo	STL Burlington	STL Chicago	STL Connecticut	STL Corpus Christi	STL Denver	STL Edison	STL Houston	STL Knoxville	STL Los Angeles	STL Miami	STL Mobile	STL Newburgh	STL North Canton	STL Pensacola	STL Pittsburgh	STL Richland	STL St. Louis	STL Sacramento	STL Savannah	STL Tallahassee	STL Tampa East	STL Tampa West	STL Valparaiso	STL Westfield
Rhode Island	DW			X			X	X			X	X						X							X	X			X
	WW						X	X	X		X	X	X					X							X	X			X
	Asbestos																													
South Carolina	DW			X				X						X				X			X	X	X	X	X	X			
	WW		X	X		IP		X						X		X	X	X		IP			X	X	X	X			
	HW		X	X		IP		X						X		X	X	X		IP			X		X	X			
	DW-Asbestos				X																									
South Dakota	DW			X																									
Tennessee	DW			X		X		X			X			X		X	X	X	X					X		X			
	DW-Asbestos				X																									
Texas	DW							X																	X	X				
	MICRO																													
	TNRCC			X						X																				
Utah	DW/HW/WW			X				X	IP		X			X					IP				X	X						
	DW/HW/WW/Radiological																													
	UST							X							X															
	DW-Asbestos			X																										
Vermont	DW						X	X																						X
	Asbestos																													
	DW-Asbestos				X																									
Virginia	DW			X		X		X						X				X		X	X			X	X	X				
	DW-Radiological																													
	DW-Asbestos																													

Certifying State/Program	Program Type	STL Anchorage	STL Austin	STL Baltimore	STL Billerica	STL Buffalo	STL Burlington	STL Chicago	STL Connecticut	STL Corpus Christi	STL Denver	STL Edison	STL Houston	STL Knoxville	STL Los Angeles	STL Miami	STL Mobile	STL Newburgh	STL North Canton	STL Pensacola	STL Pittsburgh	STL Richland	STL St. Louis	STL Sacramento	STL Savannah	STL Tallahassee	STL Tampa East	STL Tampa West	STL Valparaiso	STL Westfield
	Asbestos																													
Washington	DW																					X		X						
	WW			X		X		X	X		X			X	X					X		X	X	X	X					
	DW-Asbestos				X																									
	HW			X							X				X					X		X	X	X						
West Virginia	DW							X																						
	WW																		X	X	X									
	HW						X												X	X	X				X					
Wisconsin	General					X			X					X					X											
	DW																							IP						
	WW		x					X			X													x	X					
	HW		x					X			X																			
	UST																													
Wyoming	DW-Asbestos				X																									
	DW-Radiological																													
	DW							IP																						
	UST																								X					
Puerto Rico	Drinking Water			X																						X				
	Power Authority																									X				
American Industrial Hygiene Association (AIHA)	Asbestos, Metals, Solvents																			X										

Certifying State/Program	Program Type	STL Anchorage	STL Austin	STL Baltimore	STL Billerica	STL Buffalo	STL Burlington	STL Chicago	STL Connecticut	STL Corpus Christi	STL Denver	STL Edison	STL Houston	STL Knoxville	STL Los Angeles	STL Miami	STL Mobile	STL Newburgh	STL North Canton	STL Pensacola	STL Pittsburgh	STL Richland	STL St. Louis	STL Sacramento	STL Savannah	STL Tallahassee	STL Tampa East	STL Tampa West	STL Valparaiso	STL Westfield
US Army Corps of Engineers	Organics	X	X	X			X	X	X		X		X	X	X				X	X				X	X	X	X	X		
	Inorganic	X	X	X			X	X	X		X		X	X	X				X	X				X	X	X	X	X		
	Air																													
	Radiochemistry																													
US Department of Agriculture	Foreign Soil Permit	X	X	X		X	X	X	X		X	X	X		X	X	X	X	X	X	X	X	X	x	X	X	X	X		
USEPA Office of Groundwater & Drinking Water	QA Certificate																X			X										
Air Force Center for Environmental Excellence	AFCEE	IP	x	X		X		X	X		X				X					X				X	X		x			
Naval Facilities Engineering Services Center	NFESC			X			X	X						X	X				X	X	X			X	X					
A2LA	ISO Guide 25			X		X		X					X	X			X								X					
	Environmental Testing			X		X		X						X																
	Lead Testing			X				X																						
A2LA	ISO 9001																													
ACIL-IAETL	Seal of Excellence					X	X													X				X						
State Council of Canada	General MRA					X		X																						
State of Colorado	Radiology Material License										X																			
US Nuclear Regulatory Commission	Material License							X														X	X					X		

The codes utilized for program types are described below:

DW Drinking Water certification

HW Hazardous Waste certification

WW Wastewater certification

X Laboratory has some form of certification under the specific program. Many states certify laboratories for specific parameters or tests within a category. The information in the table indicates the lab is certified in a general category of testing. Please contact your Account Executive or Project Manager if parameter specific certification information is required.

X* Laboratory has Interim status.

IP Laboratory is in the process of obtaining certification. Please contact laboratory for most current status.

LABORATORY QUALITY MANUAL

STL Chicago
2417 Bond Street
University Park, Illinois 60466-3182
(708) 534-5200

Approved by (Signature / Date):

Michael J. Healy / 9-4-02
Michael J. Healy
Laboratory Manager

Terese A. Preston 9/4/02
Terese A. Preston
Quality Assurance Manager

CONTROLLED DISTRIBUTION
COPY # : Uncontrolled
ISSUED TO :
Full Signature Approvals Are Kept on File with STL's QA Standard Practice Records

TABLE OF CONTENTS

Tables

Figures

Appendix

1.0 Introduction, Purpose, and Scope

1.1 STL Overview

STL Chicago (STL) is a part of Severn Trent Laboratories, a major group of U.S. based companies. The companies are owned by Severn Trent, plc, an international provider of water and wastewater services headquartered in Birmingham, UK.

STL is a full-service environmental laboratory that provides quality comprehensive and integrated professional analytical services effectively and efficiently. A broad range of environmental testing services are offered that span a variety of matrices including aqueous, saline, solid, tissue and drinking water.

Associated with this activity are services to assure client requirements are known, communicated and satisfactorily addressed, and a deliverables package presenting the analytical results. The laboratory provides expert personnel for supervision, technical consultation, and project review for effective planning and implementation of analytical assignments.

STL operates under the regulations and guidelines of the following federal programs:

- Air Force Center for Environmental Excellence (AFCEE)
- US Army Corp of Engineers, Hazardous, Toxic and Radioactive Waste (USACE HTRW)
- Clean Water Act (CWA)
- Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)
- Navy Facilities Engineering Service Center (NFESC)
- National Pollution, Discharge, and Elimination System (NPDES)
- Resource Conservation and Recovery Act (RCRA)
- Safe Drinking Water Act (SDWA)
- Toxic Substances Control Act (TSCA)

STL also provides services under various state and local municipal guidelines. A current table of analytical services, list of certifications and general service listing is presented on the MySTL webpage or available from the laboratory.

1.2 Quality Assurance Policy

It is STL's policy to:

- Provide high quality, consistent, and objective environmental testing services that meet all federal, state, and municipal regulatory requirements.
- Generate data that are scientifically sound, legally defensible, meet project objectives, and are appropriate for their intended use.
- Provide STL clients with the highest level of professionalism and the best service practices in the industry.
- Build continuous improvement mechanisms into all laboratory, administrative, and managerial activities.
- Maintain a working environment that fosters open communication with both clients and staff.

1.3 Management Commitment to Quality Assurance

STL management is committed to providing the highest quality data and the best service in the environmental testing industry. To ensure that the data produced and reported by STL meet the requirements of its clients and comply with the letter and spirit of municipal, state and federal regulations, STL maintains a quality system that is clear, effective, well communicated, and supported at all levels in the company.

Line organizations verify that specifications are achieved; QA organizations assist and provide oversight and verification of processes through planning, reviews, audits, and surveillances. The quality objectives are derived from this Laboratory Quality Manual (LQM), Standard Operating Procedures (SOPs) and Work Instructions.

STL Mission Statement

We enable our customers to create safe and environmentally favorable policies and practices, by leading the market in scientific and consulting services. We provide this support within a customer service framework that sets the standard to which others aspire. This is achieved by people whose professionalism and development is valued as the key to success and through continued investments in science and technology.

1.4 Purpose

The purpose of the LQM is to describe STL's Quality System and to outline how that system enables all employees to meet the Quality Assurance (QA) policy. This LQM also describes specific QA activities and requirements and prescribes their frequencies. Roles and responsibilities of management and laboratory staff in support of the Quality System are also defined in this LQM.

1.5 Scope

This LQM is specific to STL Chicago's quality systems and laboratory operation's. All other STL locations have LQMs under the Corporate Quality Management Plan (QMP) or the Corporate QMP itself.

The laboratory is committed to ensuring that resources are available and deployed to meet client expectations. This includes gathering project information prior to sample receipt to ensure client expectations will be met with respect to:

- Sampling containers
- Analytical methods employed
- Accuracy and precision
- Reporting limits
- Personnel qualifications, training, and experience
- Calibration and quality control measures employed
- Regulatory requirements
- Report contents
- Supporting documentation, records and evidence

- Validation of data

1.6 Servicing

Project Managers are the direct client contact and they ensure resources are available to meet project requirements. Although Project Managers do not have direct reports or staff in production, they coordinate opportunities and work with laboratory management and supervisory staff to ensure available resources are sufficient to perform work for the client's project. Project Managers provide a link between the client and laboratory resources.

The laboratory has established procedures for performing and verifying that client servicing meets requirements. Typical services provided are:

- Sample Containers/Supplies – *Container Management: Process Operation* (UCM-001)
- Project QAP preparation – *Project Planning Process* (UPM-003)
- Regulatory advisory functions – *Project Planning Process* (UPM-003)
- Consulting – *Project Planning Process* (UPM-003)

Regulatory and advisory functions are addressed under the same procedures used for project planning.

2.0 References

The following references were used in preparation of this document and as the basis of the STL Quality System:

EPA Guidance for Preparing Standard Operating Procedures (SOPs) for Quality Related Documents, EPA QA/G-6, US EPA, Office of Environmental Information, March 2001.

EPA Requirements for Quality Management Plans, EPA QA/R-2, US EPA, Office of Environmental Information, March 2001.

EPA Requirements for Quality Assurance Project Plans, EPA QA/R-5, US EPA, Office of Environmental Information, March 2001.

EPA Quality Manual for Environmental Programs, 5360 A1, US EPA Office of Research and Development, National Center for Environmental Research and Quality Assurance, Quality Assurance Division, May 2000.

General Requirements for the Competence of Testing and Calibration Laboratories, ISO/IEC 17025, December 1999.

Good Automated Laboratory Practices, EPA 2185, August 1995.

Quality Assurance Project Plan, HQ Air Force Center for Environmental Excellence, Version 3.1, August 2001.

National Environmental Laboratory Accreditation Conference, Constitution, Bylaws, and Standards, EPA 600/R-00/084, US EPA Office of Research and Development, June 2000.

Navy Installation Restoration Laboratory Quality Assurance Guide, Interim Guidance Document, Naval Facilities Engineering Service Center, February 1996.

Navy Installation Restoration Chemical Data Quality Manual, Navy IR CDQM, September 1999.

Quality Systems Manual for Environmental Laboratories, Department of Defense, Version 1, October 2000.

Shell for Analytical Chemistry Requirements, US Army Corps of Engineers, December 1998.

This LQM was written to comply with the National Environmental Laboratory Accreditation Conference (NELAC) standards. Refer to Table 1 for a cross-section comparison of this LQM to the NELAC standards.

Table 1.

Correlation of QAPP Sections with NELAC 5.5.2 Quality Manual Requirements

NELAC Chapter 5.5.2 Quality Manual	Laboratory Quality Manual Section
a. Quality policy statement, including objectives and commitments	1.2 Quality Assurance Policy 4.2.1 Objectives of the Quality System
b. Organization and management structure	4.1 Organization and Management
c. Relationship between management, technical operations, support services and the quality systems	4.1.2 Roles and Requirements 4.2 Quality System
d. Records retention procedures; document control procedures	4.3 Document Control 4.12.2 Record Retention
e. Job descriptions of key staff and references to job descriptions of other staff	4.1.2 Roles and Requirements
f. Identification of laboratory approved signatories	4.1 Organization and Management
g. Procedures for achieving traceability of measurements	5.5 Measurement Traceability
h. List of all test methods under which the laboratory performs its accredited testing	5.3.1 Method Selection
i. Mechanisms for assuring the laboratory reviews all new work to ensure that it has the appropriate facilities and resources before commencing such work	4.4.2 Project-Specific Quality Planning
j. Reference to the calibration and/or verification test procedures used	5.4.3 Equipment Verification and Calibration 5.3.6.2 Data Review
k. Procedures for handling submitted samples	4.7.1 Sample Acceptance Policy 5.7 Sample Handling, Transport and Storage
l. Reference to the major equipment and reference measurement standards used as well as the facilities and services used in conducting tests	1.6 Servicing 4.1.1 Laboratory Facilities 5.4.2 Equipment Maintenance 5.4.3 Equipment Verification and Calibration
m. Reference to procedures for calibration, verification and maintenance of equipment	5.4.2 Equipment Maintenance 5.4.3 Equipment Verification and Calibration

Table 1.

Correlation of QAPP Sections with NELAC 5.5.2 Quality Manual Requirements

NELAC Chapter 5.5.2 Quality Manual	Laboratory Quality Manual Section
n. Reference to verification practices including inter-laboratory comparisons, proficiency testing programs, use of reference materials and internal QC schemes	5.8.1 Proficiency Testing 5.8.2 Control Samples
o. Procedures for feedback and corrective action whenever testing discrepancies are detected, or departures from documented procedures occur	4.9 Control of Non-Conformances 4.10 Corrective Action 4.11 Preventive Action 5.8.6 Permitting Departures from Documented Procedures
p. Laboratory management arrangements for exceptionally permitting departures from documented policies and procedures	4.4.2 Project-Specific Quality Planning 5.8.6 Permitting Departures from Documented Procedures
q. Procedures for dealing with complaints	4.8 Complaints
r. Procedures for protecting confidentiality and proprietary rights	4.7.2 Client Confidentiality and Proprietary Rights
s. Procedures for audits and data review	4.13 Internal Audits 4.14 External Audits 5.3.6 Data Reduction and Review
t. Process/procedures for establishing that personnel are adequately experienced in duties they are expected to carry out and are receiving any needed training	5.1.2 Training
u. Ethics policy statement developed by the laboratory and training personnel in their ethical & legal responsibilities	5.1.3 Ethics Policy
v. Reference to procedures for reporting analytical results	5.3.6 Data Reduction and Review 5.9 Project Reports
w. Table of contents, listing reference, glossaries and appendices	TOC Table of Contents Appendix List of Cited SOPs and Work Instructions

3.0 Terms and Definitions

Accuracy: The degree of agreement between a measurement and true or expected value, or between the average of a number of measurements and the true or expected value.

Audit: A systematic evaluation to determine the conformance to specifications of an operational function or activity.

Batch: Environmental samples, which are prepared and/or analyzed together with the same process, using the same lot(s) of reagents. A preparation batch is composed of 1 to 20 environmental samples of a similar matrix, meeting the above mentioned criteria. Where no preparation method exists (e.g., volatile organics, water), the batch is defined as environmental samples that are analyzed together with the same process and personnel, using the same lots of reagents, not to exceed 20 environmental samples. An analytical batch is composed of prepared environmental samples, extracts, digestates or

concentrates that are analyzed together as a group. An analytical batch can include prepared samples originating from various environmental matrices and can exceed 20 samples.

Chain of Custody (COC): A system of documentation demonstrating the physical possession and traceability of samples.

Comprehensive Environmental Response, Compensation and Liability Act (CERCLA/Superfund): Legislation (42 U.S.C. 9601-9675 et seq., as amended by the Superfund Amendments and reauthorization Act of 1986 (SARA), 42 U.S.C. 9601et seq.

Compromised Sample: A sample received in a condition that jeopardizes the integrity of the results. See Section 4.7.1 for a description of these conditions.

Confidential Business Information (CBI): Information that an organization designates as having the potential of providing a competitor with inappropriate insight into its management, operation or products.

Confirmation: Verification of the presence of a component using an additional analytical technique. These may include second column confirmation, alternate wavelength, derivatization, mass spectral interpretation, alternative detectors, or additional cleanup procedures.

Corrective Action: Action taken to eliminate the causes of an existing non-conformance, defect or other undesirable situation in order to prevent recurrence.

Data Audit: A qualitative and quantitative evaluation of the documentation and procedures associated with environmental measurements to verify that the resulting data are of acceptable quality.

Demonstration of Capability (DOC): Procedure to establish the ability to generate acceptable accuracy and precision.

Equipment Blank (EB): A portion of the final rinse water used after decontamination of field equipment; also referred to as Rinsate Blank and Equipment Rinsate.

Document Control: The act of ensuring that documents (electronic or hardcopy and revisions thereto) are proposed, reviewed for accuracy, approved for release by authorized personnel, distributed properly and controlled to ensure use of the correct version at the location where the prescribed activity is performed.

Federal Water Pollution Control Act (Clean Water Act, CWA): Legislation under 33 U.S.C. 1251 et seq., Public Law 92-50086 Stat. 816.

Field Blank (FB): A blank matrix brought to the field and exposed to field environmental conditions.

Field Duplicate: Duplicate field-collected sample.

Field of Testing: A field of testing is based on NELAC's categorization of accreditation based on program, matrix, analyte.

Good Laboratory Practices (GLP): Formal regulations for performing basic laboratory operations outlined in 40 CFR Part 160 and 40 CFR Part 729 and required for activities performed under FIFRA and TSCA.

Holding Time: The maximum time that a sample may be held before preparation and/or analysis as promulgated by regulation or as specified in a test method.

Instrument Blank: A blank matrix that is the same as the processed sample matrix (e.g. extract, digestate, condensate) and introduced onto the instrument for analysis.

Internal Chain of Custody: An unbroken trail of accountability that ensures the physical security of samples, data and records. Internal Chain of Custody refers to additional documentation procedures implemented within the laboratory that includes special sample storage requirements, and documentation of all signatures and/or initials, dates, and times of personnel handling specific samples or sample aliquots.

Instrument Detection Limit (IDL): The minimum amount of a substance that can be measured with a specified degree of confidence that the amount is greater than zero using a specific instrument. The IDL is associated with the instrumental portion of a specific method only, and sample preparation steps are not considered in its derivation. The IDL is a statistical estimation at a specified confidence interval of the concentration at which the relative uncertainty is ±100%. The IDL represents a range where qualitative detection occurs on a specific instrument. Quantitative results are not produced in this range.

Laboratory Control Sample (LCS): A blank matrix spiked with a known amount of analyte(s), processed simultaneously with, and under the same conditions as, samples through all steps of the analytical procedure.

Laboratory Quality Manual (LQM): A document stating the quality policy, quality system and quality practices of the laboratory. The LQM may include by reference other documentation relating to the laboratory's quality system.

Limit of Detection (LOD): The minimum amount of a substance that an analytical process can reliably detect.

Matrix: The substrate of a test sample. Common matrix descriptions are defined in Table 2.

Table 2. Matrix Descriptions

Matrix	Description
Aqueous	Aqueous sample excluded from the definition of Drinking Water or Saline/Estuarine source. Includes surface water, groundwater, effluents, leachates and wastewaters.
Drinking Water	Aqueous sample that has been designated a potable water source.
Saline	Aqueous sample from an ocean or estuary, or other salt-water source such as the Great Salt Lake.
Liquid	Liquid with <15% settleable solids.
Solid	Soil, sediment, sludge, ash, paint chips, filters, wipes or other matrices with ≥15% settleable solids.

Matrix	Description
Waste	A product or by-product of an industrial process that results in a matrix not previously defined (i.e., drum liquid or oils).
Tissue	Sample of a biological origin such as fish tissue, shellfish, or plant material. Such samples shall be grouped according to origin.

Matrix Duplicate (MD): Duplicate aliquot of a sample processed and analyzed independently; under the same laboratory conditions; also referred to as Sample Duplicate; Laboratory Duplicate.

Matrix Spike (MS): Field sample to which a known amount of target analyte(s) is added.

Matrix Spike Duplicate (MSD): A replicate matrix spike.

Method Blank (MB): A blank matrix processed simultaneously with, and under the same conditions as, samples through all steps of the analytical procedure.

Method Detection Limit (MDL): The minimum amount of a substance that can be measured with a specified degree of confidence that the amount is greater than zero using a specific measurement system. The MDL is a statistical estimation at a specified confidence interval of the concentration at which the relative uncertainty is ±100%. The MDL represents a range where qualitative detection occurs using a specific method. Quantitative results are not produced in this range.

Non-conformance: An indication, judgment, or state of not having met the requirements of the relevant specifications, contract, or regulation.

Precision: An estimate of variability. It is an estimate of agreement among individual measurements of the same physical or chemical property, under prescribed similar conditions.

Preservation: Refrigeration and/or reagents added at the time of sample collection to maintain the chemical, physical and/or biological integrity of the sample.

Proficiency Testing: Determination of the laboratory calibration or testing performance by means of inter-laboratory comparisons.

Proficiency Test (PT) Sample: A sample, the composition of which is unknown to the analyst, that is provided to test whether the analyst/laboratory can produce analytical results within specified performance limits. Also referred to as Performance Evaluation (PE) Sample.

Proprietary: Belonging to a private person or company.

Quality Assurance (QA): An integrated system of activities involving planning, quality control, quality assessment, reporting and quality improvement to ensure that a product or service meets defined standards of quality with a stated level of confidence.

Quality Assurance (Project) Plan (QAPP): A formal document describing the detailed quality control procedures by which the quality requirements defined for the data and decisions pertaining to a specific project are to be achieved.

Quality Control (QC): The overall system of technical activities, the purpose of which is to measure and control the quality of a product or service.

Quality Control Sample: A control sample, generated at the laboratory or in the field, or obtained from an independent source, used to monitor a specific element in the sampling and/or testing process.

Quality Management Plan (QMP): A formal document describing the management policies, objectives, principles, organizational authority, responsibilities, accountability, and implementation plan of an agency, organization or laboratory to ensure the quality of its product and the utility of the product to its users.

Quality System: A structured and documented management system describing the policies, objectives, principles, organizational authority, responsibilities, accountability, and implementation plan of an organization for ensuring quality in its work processes, products (items), and services. The quality system provides the framework for planning, implementing, and assessing work performed by the organization and for carrying out required QA/QC.

Quantitation Limit (QL): The minimum amount of a substance that can be quantitatively measured with a specified degree of confidence and within the accuracy and precision guidelines of a specific measurement system. The QL can be based on the MDL, and is generally calculated as 3-5 times the MDL, however, there are analytical techniques and methods where this relationship is not applicable. Also referred to as Practical Quantitation Level (PQL), Estimated Quantitation Level (EQL), Limit of Quantitation (LOQ).

Raw Data: Any original information from a measurement activity or study recorded in laboratory notebooks, worksheets, records, memoranda, notes, or exact copies thereof and that are necessary for the reconstruction and evaluation of the report of the activity or study. Raw data may include photography, microfilm or microfiche copies, computer printouts, magnetic/optical media, including dictated observations, and recorded data from automated instruments. Reports specifying inclusion of "raw data" do not need all of the above included, but sufficient information to create the reported data.

Record Retention: The systematic collection, indexing and storing of documented information under secure conditions.

Reference Standard: A standard, generally of the highest metrological quality available at a given location, from which measurements made at that location are derived.

Reporting Limit (RL): The level to which data is reported for a specific test method and/or sample. The RL is generally related to the QL. The RL must be minimally at or above the MDL.

Resource Conservation and Recovery Act (RCRA): Legislation under 42 USC 321 et seq. (1976).

Safe Drinking Water Act (SDWA): Legislation under 42 USC 300f et seq. (1974), (Public Law 93-523).

Sampling and Analysis Plan (SAP): A formal document describing the detailed sampling and analysis procedures for a specific project.

Selectivity: The capability of a measurement system to respond to a target substance or constituent.

Sensitivity: The difference in the amount or concentration of a substance that corresponds to the smallest difference in a response in a measurement system using a certain probability level.

Spike: A known amount of an analyte added to a blank, sample or sub-sample.

Standard Operating Procedure (SOP): A written document which details the method of an operation, analysis or action whose techniques and procedures are thoroughly prescribed and which is accepted as the method for performing certain routine or repetitive tasks.

Storage Blank: A blank matrix stored (2-weeks) with field samples of a similar matrix (volatiles only) that measures storage contribution to any source of contamination. OR A blank matrix stored with field samples of a similar matrix.

Systems Audit: A thorough, systematic, on-site, qualitative review of the facilities, equipment, personnel, training, procedures, record keeping, data validation, data management, and reporting aspects of a total measurement system.

Test Method: Defined technical procedure for performing a test.

Toxic Substances Control Act (TSCA): Legislation under 15 USC 2601 et seq., (1976).

Traceability: The property of a result of a measurement that can be related to appropriate international or national standards through an unbroken chain of comparisons.

Trip Blank (TB): A blank matrix placed in a sealed container at the laboratory that is shipped, held unopened in the field, and returned to the laboratory in the shipping container with the field samples.

Verification: Confirmation by examination and provision of evidence against specified requirements.

4.0 Management Requirements

The organizational chart of STL is presented in Figure 1. Corporate employees are located at various STL facilities as outlined in the organizational structure. The organizational chart of STL Chicago is presented in Figure 2.

4.1 Organization and Management

The Laboratory Manager and Quality Manager are responsible and have the signature authority for approving and implementing this plan. Additional signatory authorities for the approval of work and release of reports are defined in the *Signature Authority* SOP (UQA-030).

Figure 1. STL Organization Chart

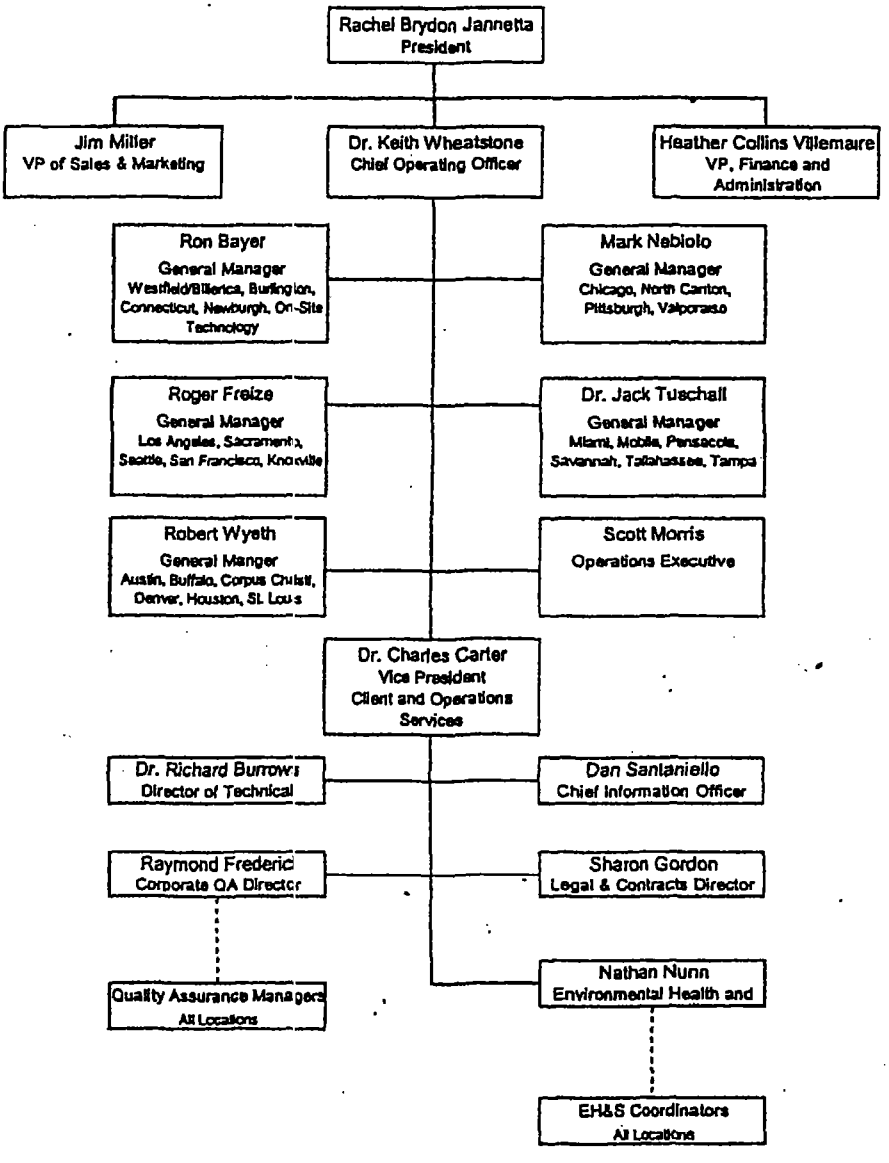
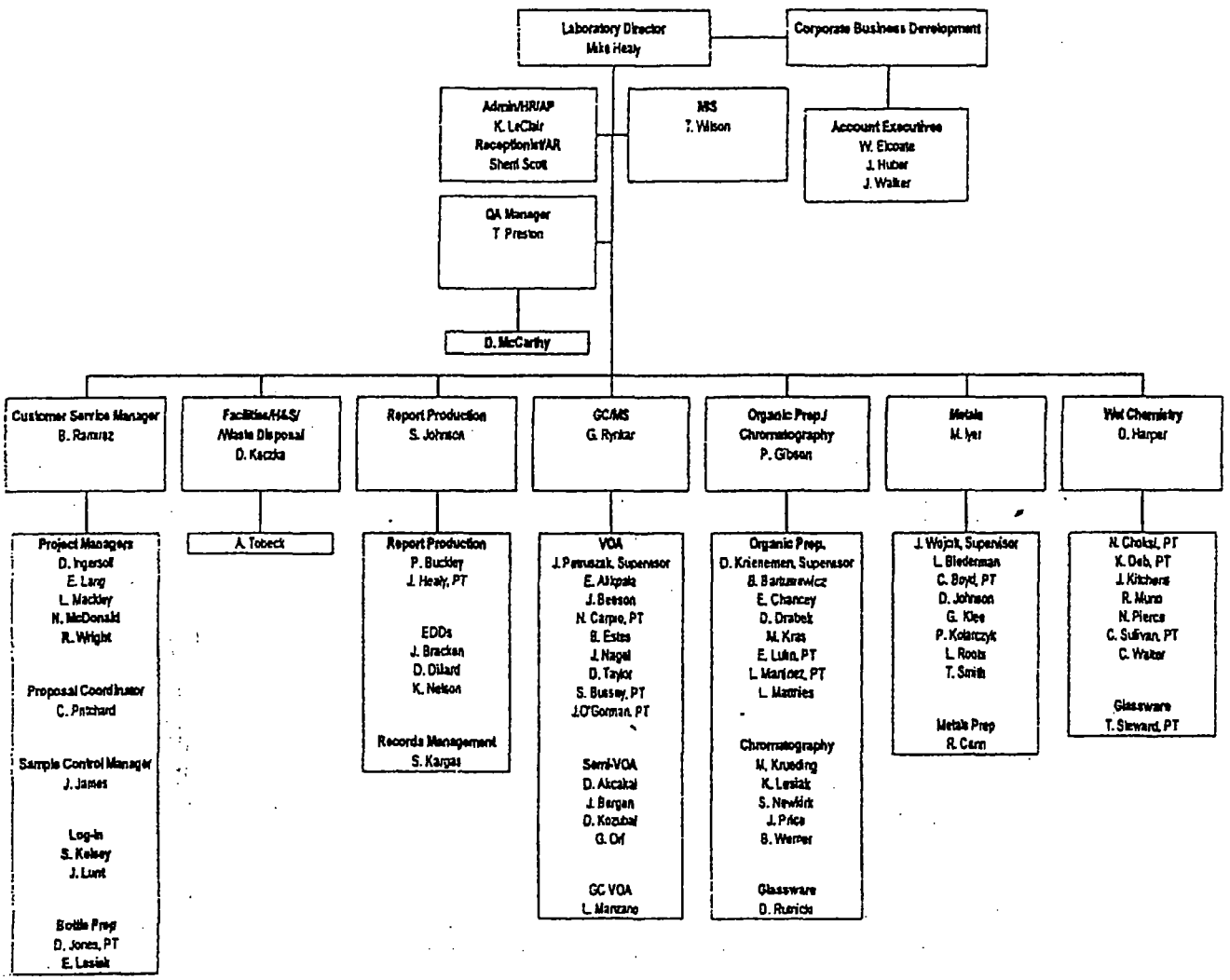


Figure 2. STL Chicago Organizational Chart



4.1.1 Laboratory Facilities

The laboratory is located in University Park, IL, which is approximately 30 miles south of Chicago, and is staffed by 82 professionals. The laboratory is comprised of 51,000 square feet of state-of-the-art commercial laboratory and office space and houses both inorganic and organic operations. The facility is divided into separate work areas to facilitate sample throughput. These areas include the following:

- Sample receipt and refrigerated storage
- Organic sample preparation
- Glassware preparation
- Metals digestion
- Wet chemistry laboratory
- Instrumentation laboratories

The main instrumentation laboratory is equipped with state-of-the-art instrumentation and sufficient duplicate equipment to provide back-up service for most major systems. A listing of laboratory equipment and instrumentation is referenced as Work Instruction No. CHI-22-09-103. Table 3 is a summary of the major laboratory instruments.

Table 3. Major Equipment List

GC	GC/MS	AA	ICP	CVAA	HPLC	AutoAnalyzer	IC	TOC	TOX
18	13	4	3	2	6	2	2	2	2

Each of these areas has separate heating, ventilation, and air conditioning systems. Non-destructive gas chromatographic detectors, and GC/MS rotary pumps are vented out of the instrumentation through charcoal filters.

4.1.2 Roles and Responsibilities

The specific duties and responsibilities of the Laboratory Manager, Quality Assurance Manager, Project Managers, Technical Managers, Sample Management Coordination, Data Management Section Manager, Quality Assurance Specialist, Health and Safety Coordinator/Waste Management, Information Technology Manager, and Chemists/Technicians are as follows.

In the absence of any one individual, the staff or assistant within each department is professionally skilled in the ability to administer the function of the administrator or support personnel. This will allow for the continuance of the day-to-day operations of the laboratory.

4.1.2.1 Laboratory Manager

The ultimate responsibility for the generation of reliable laboratory data rests with the Laboratory Manager, who is accountable to his General Manager and oversees the daily operations of the laboratory. The Laboratory Manager's responsibilities include allocation of personnel and resources, setting goals and objectives for both the business and employees, achieving the financial, business and quality objectives of STL. Furthermore, to see that all tasks performed in the laboratory are

conducted according to the requirements of this LQM, the Project Technical Profile and/or the appropriate QAPP; and to assure that the quality of service provided complies with the project's requirements.

The Laboratory Manager has the authority to effect those policies and procedures to ensure that only data of the highest level of excellence are produced. As such, the Laboratory Manager supports a QA Section which has responsibilities independent from sampling and analysis.

The Laboratory Manager, with the assistance of the Quality Assurance Manager, has the overall responsibility for establishing policies that ensure the quality of analytical services meet our clients expectations. These policies are defined in this LQM.

4.1.2.2 Quality Assurance Manager

The Quality Assurance (QA) Manager has the full-time responsibility to evaluate the adherence to policies and to assure that systems are in place to produce the level of quality defined in this LQM. The QA Manager is responsible for the approval of IDL/MDL studies, method validation studies, data package inspections; and LIMS system method development, validation and maintenance. In addition, the QA Manager may assist in the preparation, compilation, and submittal of quality assurance plans; reviews program plans for consistency with organizational and contractual requirements and advises appropriate personnel of deficiencies. The QA Manager is assisted by a QA Specialist that maintains QA records, certifications and accreditations, initiates and oversees both internal and external audits and corrective action procedures, manages the laboratory's PT Program, and maintains documentation of training.

The QA Manager shall have the final authority to accept or reject data, and to stop work in progress in the event that procedures or practices compromise the validity and integrity of analytical data. The QA Manager is available to any employee at the facility to resolve data quality or ethical issues. The QA Manager shall be independent of laboratory operations and has an indirect reporting relationship to the QA Director.

4.1.2.3 Project Managers

The laboratory recognizes the importance of efficient project management. The laboratory Project Managers (PM) are responsible for preparing the Project Technical Profile which summarizes QA/QC requirements for the project, maintaining the laboratory schedule, ensuring that technical requirements are understood by the laboratory, and advising the Laboratory, QA and Technical Managers of all variances. The laboratory Project Manager will provide technical guidance and the necessary laboratory-related information to the preparer of project-specific QAPPs and provide peer review of the final document to ensure accuracy of the laboratory information.

4.1.2.4 Technical Managers

The Technical Managers are the Laboratory Manager, laboratory Section Managers and the QA Manager. They are as follows:

- Michael J. Healy, Laboratory Manager, BS Environmental Biology, 19 years laboratory experience.

- Terese A. Preston, Quality Assurance Manager, BA Biology, 18 years laboratory experience.
- Diane L. Harper, Inorganics Section Manager, MA Biology, 27 years laboratory experience.
- Mani S. Iyer, Metals Section Manager, BA Chemistry, 30 years laboratory experience.
- Patti J. Gibson, Chromatography/Organic Extractions Section Manager, BS Biology, 13 years laboratory experience.
- Gary L. Rynkar, GC/MS Section Manager, BS Environmental Biology, 13 years laboratory experience.

All of these managers report to the Laboratory Manager and serve as the technical experts on assigned projects, provide technical liaison, assist in resolving any technical issues within the area of their expertise; and implement established policies and procedures to assist the Laboratory Manager in achieving section goals. The Technical Managers are responsible for ensuring that their personnel are adequately trained to perform analyses; that equipment and instrumentation under their control is calibrated and functioning properly; that system and performance audits are performed on an as-needed basis; provide input and review in the development and implementation of project-specific QA/QC requirements; and for providing the critical review of proposal and project work for programs as directed by the Laboratory Manager. The Technical Managers coordinate these activities with the project management and quality assurance sections.

4.1.2.5 Sample Management Coordination

The Project Manager is designated as the Sample Management Coordination for any work subcontracted under their management. The Project Manager verifies each subcontracting request to ensure that special client restrictions are not jeopardized (e.g., samples must be analyzed by the receiving affiliated or network laboratory and must maintain specific certification(s)). The Project Manager is also responsible for verifying the credentials; establishing the service agreement; ensuring data review; and invoicing of all laboratory subcontractors. The Project Manager discusses any deficiencies or anomalies with the subcontractor prior to reporting any data to the client. The Project Manager processes and functions are further defined in the *Sample Management* SOP (USM-001).

4.1.2.6 Data Management Section Manager

The Data Management Section Manager is responsible for coordinating receipt of all data from the various service groups within the laboratory, reviewing data for compliance to laboratory QC criteria and/or criteria in the Project Technical Profile, and ensuring that data are reported in a timely manner and in the proper format.

4.1.2.7 Quality Assurance Specialist

The QA Specialist is responsible for conducting and evaluating results from system audits; the preparation of SOPs and QA documentation, reviews program plans for consistency with organizational and contractual requirements and will advise appropriate personnel. The QA Specialist also:

- Preparation, compilation, submittal and review of Quality Assurance Plans,

- Performs annual internal audits,
- Manages the performance testing (PT) studies and personnel training records,
- Manages document control,
- Assists the Project Management Group, and
- Manages certifications and accreditations.

4.1.2.8 Health and Safety Coordinator / Waste Management

The Health and Safety Coordinator is responsible for the safety and well-being of all employees while at the laboratory. This includes, but is not limited to, administering the Corporate Safety Manual that complies with federal regulations, MSDS training and review, conducting laboratory safety orientation and tours for all new employees, providing instructions on safety equipment, cleaning up laboratory spills, and instructing personnel of laboratory procedures for emergency situations. The Health and Safety Coordinator is on-call 24-hours a day, 7-days a week for all laboratory situations.

The Health and Safety Coordinator responsibilities additionally include waste management of laboratory generated hazardous waste in accordance with appropriate regulations. This includes maintenance of required documentation, such as waste manifests, segregation of waste in accordance with requirements, and training of personnel in proper segregation of waste.

4.1.2.9 Information Technology Manager

The overall role of the Information Technology (IT) Manager is to enhance laboratory productivity through improved information access, flow, and security. For information to be of greatest value, it must be readily accessible and reliable. It is the responsibility of the IT Manager to provide software tools that allow quick and user friendly access to that information, while at the same time controlling access to that information to those that have the need and proper authority.

Information flow can be enhanced through automation. Automation is the minimization of human intervention in a process. Reduction in human intervention can result in significant error reductions and time savings. The IT Manager assists the laboratory in automation by providing hardware and software solutions to help minimize human intervention in data collection, processing, and storage.

The IT Manager is responsible for providing data security by controlling access, as mentioned above, and for providing for disaster recovery. Data stored on the central Laboratory Information Management System (LIMS, a.k.a., LabNet) is the direct responsibility of the IT Manager. No fewer than two copies of all data should exist at any time so that lost or destroyed data can always be retrieved from an alternate source. These copies may consist of data within the system and on magnetic tape in the case of live data, or two copies on magnetic tape for archived data. Data stored electronically in other departments is the direct responsibility of those departments. However, the IT Manager is responsible for providing procedures and training to all laboratory operations, as appropriate, to assist in making backup copies of local data within the respective operating unit.

STL has established procedures for IT management:

- *Computer System Account and Naming Policy* – P-I-003
- *Password Policy* – P-I-004
- *Software Licensing* – P-I-005
- *Virus Protection Policy* – P-I-006

4.1.2.10 Chemists / Technicians

Any effective laboratory quality assurance/quality control program depends on the entire organization, including management and every individual on the laboratory staff. The initial review for acceptability of analytical results rests with the analysts conducting the various tests. Observations made during the performance of an analytical method may indicate that the analytical system is not in control. Analysts must use quality control indicators to assure that the method is in-control before reporting results.

4.2 Quality System

Organizational support for implementing the quality system and achieving the quality objectives is derived from this LQM, SOPs and Work Instructions. Within these documents, management with executive responsibilities ensures that the quality policy is understood, implemented, and maintained at all levels of the organization. The development and implementation of appropriate accountabilities, duties, and authority by organizational positions are clearly delineated. Line organizations achieve and verify that specifications are achieved; QA organizations assist and provide oversight and verification of processes through planning, reviews, audits, and surveillances. Top management leadership, support and direction ensures that the policies and procedures are appropriately implemented.

4.2.1 Objectives of the Quality System

The goal of the Quality System is to ensure that business operations are conducted with the highest standards of professionalism in the industry.

To achieve this goal, it is necessary to provide our clients with not only scientifically sound, well documented, and regulatory compliant data, but also to ensure that we provide the highest quality service available in the industry. A well-structured and well-communicated Quality System is essential in meeting this goal. The laboratory's Quality System is designed to minimize systematic error, encourage constructive, documented problem solving, and provide a framework for continuous improvement within the organization.

As stated in Section 1.3, this LQM, Work Instructions and the SOPs themselves are the basis and outline for our Quality System and contains general guidelines under which the laboratory conducts our operations. In addition, other documents may be used by the laboratory to clarify compliance with quality system or other client requirements. As you read this LQM, you will note SOP or Work Instruction numbers in parenthetic text. These numbers refer to the laboratory procedure(s) associated with the subject item. A table listing these quality system policies and procedures is appended to this LQM.

The QA Manager and QA Specialist are responsible for implementing and monitoring the Quality System. The QA Manager reports to the Laboratory Manager on the performance of the quality system for review and continuous improvement. The QA Manager has sufficient authority, access to work areas, and organizational freedom (including sufficient independence from cost and schedule considerations) to:

- Initiate action to prevent the occurrence of any nonconformities related to product, process and quality system,
- Identify and record any problems affecting the product, process and quality system,
- Initiate, recommend, or provide solutions to problems through designated channels,
- Verify implementation of solutions, and
- Assure that further work is stopped or controlled until proper resolution of a non-conformance, deficiency, or unsatisfactory condition has occurred and the deficiency or unsatisfactory condition has been corrected.

The QA Manager reports where appropriate action can be affected. However, should a situation arise where acceptable resolution of identified problems cannot be agreed upon at the laboratory level, direct access to STL's Corporate Quality Director is available. This provides laboratory QA personnel non-laboratory management support, if needed, to ensure that QA policies and procedures are enforced.

The QA Manager conducts annual LQM training for all laboratory and administrative personnel to ensure their familiarity with the quality documentation and the implementation of the policies and procedures in their work.

4.3 Document Control

The laboratory maintains procedures to control documents and analytical data. Since intensive data is generated and this is our primary product, document control is inherently segregated from data control, as described further in Sections 4.3.1 and 4.3.2.

4.3.1 Document Control Procedure

Security and control of documents are necessary to ensure that confidential information is not distributed and that all current copies of a given document are from the latest applicable revision (*Document Control*; UQA-006). Unambiguous identification of a controlled document is maintained by identification of the following items in the document header: Document Number, Revision Number, Effective Date, and Number of Pages. Document control may be achieved by either electronic or hardcopy distribution.

Controlled documents are authorized by the QA Department and are marked as either "Controlled" or "Uncontrolled" and records of their distribution are kept by the QA Department. Controlled status is defined as the continuous distribution of document updates. Uncontrolled status is defined as the single distribution of the current SOP. Document updates are not distributed to uncontrolled status holders. For tracking purposes, a control copy number is assigned to documents distributed with a controlled status. All copy numbers are written in red ink or type to easily identify the SOP as a controlled copy.

4.3.1.1 Document Revision

Changes to documents occur when a procedural change warrants a revision of the document. When an approved revision of a controlled document is ready for distribution, obsolete copies of the document are replaced with the current version of the document. The previous revision of the

controlled document is stamped "ARCHIVED COPY" and are stored by the QA Specialist in secured cabinets. Only the most current revision is maintained electronically.

SOPs are updated on a 12-18 month basis, which is tracked by an established review schedule (*Approved SOP Listing*; CHI-22-09-SOP List). These reviews are conducted by the writer/reviewer and/or QA Manager or Specialist, the department manager and the Health and Safety Coordinator, all of whom provide the approval signature for each SOP.

4.3.2 Data Control

All raw data, such as bound logbooks, instrument printouts, magnetic tapes, electronic data, as well as final reports, are retained for a minimum period of 5 years. Such data may be maintained longer, as defined by client and project requirements. Specifics on the procedure of archiving records and client or project specific requirements is contained in the *Record Retention and Purging* SOP (UDM-002).

Raw data and reports are documented and stored in a manner which are easily retrievable. The procedure for maintaining raw data records is briefly described below:

- Instrument print-outs for conventional inorganic parameters are filed by LabNet Batch Number. Inorganic Metals are filed by Instrument and Filename. Generally, current year and previous year documents are kept on file in the laboratory sections.
- All raw data, for example, instrument print-outs and logbooks, are maintained in an on-site and secured storage area.
- The computer information is backed up on tape daily, and stored in a secured and temperature/humidity controlled environment to maintain the integrity of the electronic information in the event of system failure. Copies of all back-up tapes are maintained in secured off-site locations.
- All copies of client final reports are maintain electronically (e.g., Adobe Acrobat).

4.4 Request, Tender, and Contract Review

4.4.1 Contract Review

For many environmental sampling and analysis programs, testing design is site or program specific and does not necessarily "fit" into a standard laboratory service or product. It is STL's intent to provide both standard and customized environmental laboratory services to our clients. To ensure project success, technical staff performs a thorough review of technical and QC requirements contained in contracts. Contracts are reviewed for adequately defined requirements and STL's capability to meet those requirements.

All contracts entered into by STL are reviewed and approved by the appropriate management personnel to ensure that the laboratory's test methods are suitable to achieve these requirements and must ensure that the laboratory holds the appropriate certifications and approvals to perform the work. The review also includes the laboratory's capabilities in terms of turnaround time, capacity, and resources to provide the services requested, as well as the laboratory's ability to provide the documentation, whether hardcopy or electronic. If the laboratory cannot provide all services but intends to subcontract such services to another STL facility, this will be documented and discussed with the client prior to contract approval.

Any contract requirement or amendment to a contract communicated to STL verbally is documented and confirmed with the client in writing. Any discrepancy between the client's requirements and STL's capability to meet those requirements is resolved in writing before acceptance of the contract. Contract amendments, initiated by the client and/or STL, are documented in writing for the benefit of both the client and STL.

All contracts, QAPPs, Sampling and Analysis Plans (SAPs), contract amendments, and documented communications become part of the permanent project record as defined in Section 4.12.1.

4.4.2 Project-Specific Quality Planning

Communication of contract specific technical and QC criteria is an essential activity in ensuring the success of site specific testing programs. To achieve this goal, STL assigns a Project Manager to each client. The Project Manager is the first point of contact for the client. It is the Project Manager's responsibility to ensure that project specific technical and QC requirements are effectively evaluated and communicated to the laboratory personnel before and during the project (*Project Planning Process*; UPM-003). QA department involvement may be needed to assist in the evaluation of custom QC requirements.

Project Managers are the direct client contact and they ensure resources are available to meet project requirements. Although Project Managers do not have direct reports or staff in production, they coordinate opportunities and work with laboratory management and supervisory staff to ensure available resources are sufficient to perform work for the client's project. Project management is positioned between the client and laboratory resources.

Prior to work on a new project, the dissemination of project information and/or project opening meetings will occur to discuss schedules and unique aspects of the project. Items to be discussed may include the project Technical Profile (e.g., LabNet Project Notes) turn around times, holding times, methods, analyte lists, reporting limits, deliverables, sample hazards, or other special requirements. The Project Manager introduces new projects to the laboratory staff through Project Kick-Off Meetings (UPM-002). These meetings provide direction to the laboratory staff in order to maximize production and client satisfaction, while maintaining quality. In addition, the LabNet Project Notes are associated with each sample batch (e.g., Job) as a reminder upon sample receipt and analytical processing.

Any changes that may occur within an active project is agreed upon between the client/regulatory agency and the Project Manager/laboratory. These changes, e.g., use of a non-standard method or modification of a method, must be documented prior to implementation. Documentation pertains to any document, e.g., letter, variance, contract addendum, which has been signed by both parties.

Such changes are communicated to the laboratory through management Production Meetings, which are conducted twice per week. Such changes are updated to the Technical Profile / LabNet Project Notes and are introduced to the managers at these meetings. The laboratory staff is then introduced to the modified requirements via the Project Manager or the individual laboratory section manager. After the modification is implemented into the laboratory procedure, documentation of the modification is made in the case narrative of the data report(s).

STL strongly encourages our clients to visit the laboratory and hold formal or informal sessions with employees in order to effectively communicate ongoing client needs as well as project specific details for customized testing programs.

4.4.3 Data Quality Objectives

Data quality objectives (DQO) are qualitative and quantitative statements used to ensure the generation of the type, quantity, and quality of environmental data that will be appropriate for the intended application. Typically, DQOs are identified before project initiation and during the development of a QAPPs and SAPs. The analytical DQOs addressed in this section are precision, accuracy, representativeness, completeness, and comparability.

The components of analytical variability (uncertainty) can be estimated when QC samples of the right types and at the appropriate frequency are incorporated into the measurement process of the laboratory. STL incorporates numerous QC samples to obtain data for comparison with the analytical DQOs and to ensure that the measurement system is functioning properly. The control samples and their applications, described in Section 5.8.2, are selected based on regulatory, method- or client-specific requirements. Analytical QC samples for inorganic and organic analyses may include calibration blanks, instrument blanks, method blanks, laboratory control samples, calibration standards, MS, MSD, MD, surrogate spikes, and yield monitors.

The DQOs discussed below ensure that data are gathered and presented in accordance with procedures appropriate for its intended use, that the data is of known and documented quality, and are able to withstand scientific and legal scrutiny.

4.4.3.1 Precision

Precision is an estimate of variability. It is an estimate of agreement among individual measurements of the same physical or chemical property, under prescribed similar conditions. Precision is expressed either as Relative Standard Deviation (RSD) for greater than two measurements or as Relative Percent Difference (RPD) for two measurements. Precision is determined, in part, by analyzing data from LCSs, MS, MSD, and MD. A description of these control samples is provided in Section 5.8.2.

Precision also refers to the measurement of the variability associated with the entire process, from sampling to analysis. Total precision of the process can be determined by analysis of duplicate or replicate field samples and measures variability introduced by both the laboratory and field operations.

4.4.3.2 Accuracy

Accuracy is the degree of agreement between a measurement and the true or expected value, or between the average of a number of measurements and the true or expected value. It reflects the total error associated with a measurement.

Both random and systematic errors can affect accuracy. For chemical properties, accuracy is expressed either as a percent recovery (R) or as a percent bias (R - 100). Accuracy is determined, in part, by analyzing data from LCSs, MS and MSD.

Accuracy and Precision objectives employed by the laboratory are as defined in the CERCLA's Inorganic and Organic Statements of Work (SOW); statistically-derived control limits; or default limits as listed in each respective method SOP.

4.4.3.3 Representativeness

Representativeness is the degree to which data accurately and precisely represent a characteristic of a population, a variation in a physical or chemical property at a sampling point, or an environmental condition. Data representativeness is primarily a function of sampling strategy; therefore, the sampling scheme must be designed to maximize representativeness. Representativeness also relates to ensuring that, through sample homogeneity, the sample analysis result is representative of the constituent concentration in the sample matrix. STL makes every effort to analyze an aliquot that is representative of the original sample, and to ensure the homogeneity of the sample before sub-sampling.

4.4.3.4 Completeness

Completeness is defined as the percentage of measurements that are judged valid or useable. Factors negatively affecting completeness include the following: sample leakage or breakage in transit or during handling, loss of sample during laboratory analysis through accident or improper handling, improper documentation such that traceability is compromised, or sample result is rejected due to failure to conform to QC specifications. A completeness objective of greater than 90% of the data specified by the statement of work is the goal established for most projects.

4.4.3.5 Comparability

Comparability is a measure of the confidence with which one data set can be compared to another. To ensure comparability, all laboratory analysts are required to use uniform procedures (e.g., SOPs) and a uniform set of units and calculations for analyzing and reporting environmental data.

A measure of inter-laboratory comparability is obtained through the laboratory's participation in performance testing (PT) programs established with Water Supply (WS), Water Pollution (WP), and Solid Waste (SW) programs. In addition, the laboratory employs the use of NIST or EPA traceable standards, when available, to provide an additional measure of assurance of the comparability of data.

Project representativeness and comparability are dependent upon the sampling plan on a project specific basis, and are therefore not covered in this LQM. Assessment of site and collection representativeness and comparability is performed by the field engineer.

4.4.3.6 Additional DQOs

Method Detection Limits
The method detection limit (MDL) is the lowest concentration that can be detected for a given analytical method and sample matrix with 99% confidence that the analyte is present. The MDL is determined according to Appendix B of 40 CFR 136, "Guidelines Establishing Test Procedures for the Analysis of Pollutants". MDLs reflect a calculated (statistical) value determined under ideal laboratory conditions in a clean matrix, and may not be achievable in all environmental matrices. The laboratory maintains MDL studies for analyses performed; these are verified at least annually.

For the performance of non-routine methods, e.g., client/contract requirement, MDLs or Method Validation Studies will be completed on an as needed basis. The turnaround time for such studies will be as determined by the client and Project Manager. Such studies will be reviewed and approved by the client and/or regulatory agency prior to project implementation.

Instrument Detection Limits
There are a number of ways to determine Instrument Detection Limit (IDL) sensitivity (e.g., signal-to-noise ratio; precision of the low-level standard; lowest calibration curve point or the IDL study defined within CLP). The method and means in which IDLs are determined are documented and maintained in the QA department for each individual instrument.

IDLs are generated for each element by the metals laboratory quarterly via each instrument as specified in CLP. These limits are used to gauge instrument sensitivity and when routinely evaluated, instrument performance without the introduction of method variance can be determined.

Reporting Limits
Reporting Limits are defined as the lowest concentration of an analyte determined by a given method in a given matrix that the laboratory feels can be reported with acceptable quantitative error or client requirements, values specified by the EPA methods or other project and client requirements. The laboratory reporting limits are further related and verified by the lowest point on a calibration curve. Because of the high level of quantitative error associated with determinations at the level of the MDL, the laboratory endeavors to keep reporting limits higher than the MDL. Wherever possible, reporting is limited to values approximately 3-5x the respective MDL to ensure confidence in the value reported. Client specific requests for reporting to the IDL or MDL are special circumstances not to be confused with the previous statement. Data evaluated down to the MDL/IDL is qualified as estimated with a 'J' for organic analyses and a 'B' for inorganic analyses on the data report.

MDL studies are performed annually, and reporting limits are assessed. If the MDL does not meet the routine laboratory reporting limit or the method specified limit, it is repeated or the laboratory reporting limit is reassessed. If the laboratory continually demonstrates that the method reporting limits are not achieved, equipment, technique, and the method are reviewed to assure optimal performance or appropriate action is taken.

4.5 Subcontracting

Subcontracting is arranged with the documented consent of the client, in a timely response which shall not be unreasonably refused. All QC guidelines specific to the client's analytical program are transmitted to the subcontractor and agreed upon before sending the samples to the subcontract

facility. Proof of required certifications from the subcontract facility are maintained in the project records. Where applicable, specific QC guidelines, QAPPs, and/or SAPs are transmitted to the subcontract laboratory. Samples are subcontracted under formal Chain of Custody (COC).

Subcontract laboratories may receive an on-site audit by a representative of STL's QA staff if it is deemed appropriate by the QA Manager. The audit involves a measure of compliance with the required test method, QC requirements, as well as any special client requirements (e.g., Technical Profile and LabNet Project Notes).

Intra-company subcontracting may also occur between STL facilities. Intra-company subcontracting within STL is arranged with the documented consent of the client (e.g., QAPP). The originating laboratory is responsible for communicating all technical, quality, and deliverable requirements as well as other contract needs.

Project reports from both STL and external subcontractors are not altered and are included in their original form in the final project report provided by STL. This clearly identifies the data as being produced by a subcontractor facility. All data, as required in Section 5.9.4, is included.

4.6 Purchasing Services and Supplies

Evaluation and selection of suppliers and vendors is performed, in part, on the basis of the quality of their products, their ability to meet the demand for their products on a continuous and short term basis, the overall quality of their services, their past history, and competitive pricing. This is achieved through evaluation of objective evidence of quality furnished by the supplier, which can include certificates of analysis, recommendations, and proof of historical compliance with similar programs for other clients. To ensure that quality critical consumables and equipment conform to specified requirements, all purchases from specific vendors are approved by a member of the supervisory or management staff.

Chemical reagents, solvents, glassware, and general supplies are ordered as needed to maintain sufficient quantities on hand. Purchasing guidelines for equipment and reagents meet with the requirements of the specific method and testing procedures for which they are being purchased. The measurements for evaluation and selection of suppliers; the acceptance of supplies and services; and certificates of conformance are described in the procurement SOP (*Procurement Quality Assurance Process*; UQA-020).

4.6.1 Solvent and Acid Lot Verification

Pre-purchase approval is performed for solvents and acids purchased in large quantities unless a certificate of conformance has been furnished. These may include acetone, ethyl ether, hexane, methylene chloride, nitric acid, hydrochloric acid, sulfuric acid, and hydrogen peroxide. Each lot of incoming supplies requiring pre-approval is checked against the previously approved lot number. If the lot number is not approved, the lot is refused. If the lot number is an approved lot number, it is accepted and documented. Solvents and acids are pre-tested in accordanoe with STLs Corporate *Testing Solvents and Acids* procedure (S-T-001).

4.7 Service to the Client

4.7.1 Sample Acceptance Policy

Samples are considered "compromised" if the following conditions are observed upon sample receipt:

- Cooler and/or samples are received outside of temperature specification.
- Samples are received broken or leaking.
- Samples are received beyond holding time.
- Samples are received without appropriate preservation.
- Samples are received in inappropriate containers.
- COC does not match samples received.
- COC is not properly completed or not received.
- Breakage of any Custody Seal.
- Apparent tampering with cooler and/or samples.
- Headspace in volatiles samples.
- Seepage of extraneous water or materials into samples.
- Inadequate sample volume.
- Illegible, impermanent, or non-unique sample labeling.

When "compromised" samples are received, it is documented on the hardcopy COC, the LabNet Sample Receipt Checklist and on a Sample Discrepancy Report (SDR); and the client is contacted for instructions. If the client decides to proceed with the analysis, the project report will clearly indicate any of the above conditions and the resolution.

4.7.2 Client Confidentiality and Proprietary Rights

Data and sample materials provided by the client or at the client's request, and the results obtained by STL, shall be held in confidence (unless such information is generally available to the public or is in the public domain or client has failed to pay STL for all services rendered or is otherwise in breach of the terms and conditions set forth in the STL and client contract) subject to any disclosure required by law or legal process. Technical, business and proprietary information provided by a client and data/information generated by the laboratory are restricted for the use within the laboratory for purposes of accomplishing the project. Client information is not to be used on other projects or revealed except in conjunction with project work to anyone outside the laboratory without permission of the client.

STL's reports, and the data and information provided therein, are for the exclusive use and benefit of client, and are not released to a third party without written consent from the client (*Client Confidentiality*; UQA-004).

4.8 Complaints

Client inquiries, complaints or noted discrepancies are documented, communicated to management, and addressed promptly and thoroughly. The investigation of the cause, resolution and authorization

of corrective action is documented [*Sample Discrepancy Report (SDR), Resubmitted Data Request (RDR), Corrective Action Report (CAR)*; UQA-029].

Client complaints are documented by the employee receiving the complaint. The documentation can take the form of a Resubmitted Data Request (RDR) or in a format specifically designed for that purpose (e.g., phone conversation record or e-mail). The Laboratory Manager, Project Manager and/or QA Manager are informed of client complaints and assist in resolving the complaint.

The RDR is used after the client has received the analytical report and their specifications, expectations, or client satisfaction were not achieved. RDRs are prepared when clients request re-evaluation of submitted data, when additional information is requested or for general complaints.

The nature of the complaint is identified, documented and investigated, and an appropriate action is determined and taken. In cases where a client complaint indicates that an established policy or procedure was not followed, the QA department is required to conduct a special audit to assist in resolving the issue. A written confirmation, or letter to the client, outlining the issue and response taken is strongly recommended as part of the overall action taken.

The number and nature of client complaints is reported by the QA Manager in the QA Monthly report. Monitoring and addressing the overall level and nature of client complaints and the effectiveness of the solutions is part of the *Quality Systems Management Review* (UQA-002).

4.9 Control of Non-conformances

Non-conformances include any out of control occurrence. Non-conformances may relate to client specific requirements, procedural requirements, or equipment issues. All non-conformances in the laboratory are documented at the time of their occurrence on Corrective Action Reports (CARs) specifically formatted for each department or on a SDR.

All non-conformances that affect a sample and/or sample data become part of the affected project's permanent record. When appropriate, reanalysis is performed where QC data falls outside of specifications, or where data appears anomalous. If the reanalysis comes back within established tolerances, the results are approved. If the reanalysis is still outside tolerances, further reanalysis or consultation with the Section Manager, Project Manager or QA Manager for direction may be required. All records of reanalysis are kept with the project files.

Where non-conformances specifically affect a client's sample and/or data, the client is informed and action must be taken. Action can take the form of reporting and flagging the data, and including a description of the non-conformance in the project narrative.

4.10 Corrective Action

To consistently achieve technical and regulatory requirements, the laboratory data must be supported by an effective corrective action system. The system must be capable of isolating and rectifying both random and systematic errors. Identification of systematic errors, or errors that are likely to occur repetitively due to a defect or weakness in a system, is particularly valuable in maintaining an environment of continuous improvement in laboratory operations.

Mechanisms used to ensure problem definition include SOPs; internal and external audits and surveillances; and regular laboratory management meetings. When evaluation of performance against established criteria for good laboratory practices shows a condition that could adversely affect the quality of services provided, corrective action is initiated.

All corrective actions, whether immediate or long-term, will comprise the following steps to ensure a closed-loop corrective action process:

- Define the problem.
- Assign responsibility for investigating the problem.
- Determine a corrective action to eliminate the problem.
- Assign, and obtain commitment to, responsibility for implementing the corrective action.
- Implement the correction.
- Assess the effectiveness of the corrective action and verify that the corrective action has eliminated the problem.

4.10.1 Immediate Corrective Action

Immediate corrective actions to correct or repair non-conforming equipment and systems are generally initiated in response to adverse conditions identified through QC procedures. The analyst has relatively quick feedback that a problem exists, e.g., calibration does not meet or QC check samples exceed allowable criteria, and can take immediate action to repair the system.

The initial responsibility to monitor the quality of a function or analytical system lies with the individual performing the task or procedure. DQOs are evaluated against laboratory-established or against method or client specified QA/QC requirements. If the assessment reveals that any of the QC acceptance criteria are not met, the analyst must immediately assess the analytical system to correct the problem. When the appropriate corrective action measures have been defined and the analytical system is determined to be "in-control" or the measures required to put the system "in-control" have been identified and scheduled, the problem and resolution or planned action is documented in the appropriate logbook or CAR. Data generated by an analytical system that is determined to be out-of-control must never be released without approval of the Section Manager, QA Manager, Laboratory Manager and client notification.

When an acceptable resolution cannot be met or data quality is negatively affected, the analyst will notify their Section Manager and initiate an SDR. If an SDR is required, it is routed for proper authorizations and direction. Proper authorization and direction is given by the Project Manager and/or QA Manager. Based upon the circumstances and judgment of the Project Manager, the client may be notified of the situation.

Data generated concurrently with an out-of-control system will be evaluated for usability in light of the nature of the deficiency. If the deficiency does not impair the usability of the results, data will be reported and the deficiency will be noted in the case narrative. Where sample results may be impaired, the Project Manager is notified by a written SDR and appropriate corrective action (e.g., reanalysis) is taken and documented.

A CAR documents analytical problems at the bench level. This form allows for the documentation of the out-of-control situation, actions undertaken to correct the problem and a return-to-control status. All CARs are signed/dated by the respective laboratory section manager.

The QA Manager has the authority to stop the analysis, e.g., failure to meet method or project requirements, and to hold all analyses of samples affected by an out-of-control situation. The method cannot be restarted without appropriate documentation leading to the QA Manager's approval and sign-off.

4.10.2 Long-term Corrective Action

Long-term corrective action is generally initiated due to QA issues, which are most often identified during internal and external audits (Sections 4.13 & 4.14). Typically, a deeper investigation into the root cause of the nonconformance is warranted, and the problem may take much longer to identify and resolve. Staff training, method revision, replacement of equipment, and LabNet reprogramming are examples of long-term corrective action.

4.10.3 Responsibility and Closure

The Section Manager is responsible for correcting out-of-control situations, placing highest priority on this endeavor. Associated corrective actions, once verified for effectiveness, are incorporated into standard practices. Ineffective actions will be re-evaluated until acceptable resolution is achieved. Section Managers are accountable to the Laboratory Manager to ensure final acceptable resolution is achieved.

The QA Department also may implement a special audit (Section 4.13). The purpose of inclusion of the corrective action process in both routine and special audits is to monitor the implementation of the corrective action and to determine whether the action taken has been effective in overcoming the issue identified.

Any out-of-control situations that are not addressed acceptably at the laboratory level may be reported to the Corporate Quality Director by the QA Manager, indicating the nature of the out-of-control situation and problems encountered in solving the situation. This provides laboratory QA personnel non-laboratory management support, if needed, to ensure QA policies and procedures are enforced.

4.11 Preventative Action

The laboratory's preventive action programs improve, or eliminate potential causes of nonconforming product and/or nonconformance to the quality system. This preventive action process is a proactive continuous process improvement activity which can be initiated by clients, employees, business providers, and affiliates. The QA section has the overall responsibility to ensure that the preventive action process is in place, and that relevant information on actions is submitted for management review.

Preventive action opportunities may be identified from information obtained through activities related to but not limited to the corrective action process, performance evaluation program, internal audits, management review, and/or market trends, industry trends and competitive comparisons.

Established standard practices for preventive action are included in the *Preventive Action Measures* SOP (UQA-019); the *SDR / RDR / CAR* SOP (UQA-029) and the *Quality System Management Review* SOP (UQA-002). These procedures describe the information sources used to detect, analyze, and eliminate potential causes of nonconformities and to ensure effective implementation of solutions.

4.12 Records

4.12.1 Record Types

Record types are described in Table 4.

4.12.2 Record Retention

Data reports are filed electronically as .pdf files by sample job number. Hardcopy COC files are maintained and are filed in Job Number order.

Laboratory data, project management files, QA records (e.g., PT scores/corrective actions; MDLs/IDLs, statistical analysis, QAPPs, etc..), Human Resources information, etc.., are compiled by date order. The same procedure is followed both in current and archived hardcopy storage.

Upon archiving, a *Records Management Form* (CHI-22-05-032) is prepared for each storage box of records. This form documents the department, department manager, contents (description and dates), term of retention (e.g., no. of years) and an assigned identification number. The original of this form is maintained with the data management department with a carbon copy filed within the storage box. Upon purging of records, the individual department managers sign the original form as confirmation for the destruction of the associated data. This signature indicates that the laboratory has maintained the information for the required amount of time and is no longer required to store it.

Table 5 outlines the laboratory's standard record retention time. For raw data and project records, record retention is calculated from the date the project report is issued. For other records, such as Controlled Documents, QC, or Administrative Records, the retention time is calculated from the date the record is formally retired. Records related to the programs listed in Table 6 have lengthier retention requirements and are subject to the requirements in Section 4.12.3.

Table 4. STL Record Types

Raw Data	Controlled Documents	QC Records	Project Records	Administrative Records
See Section 3. Terms and Definitions	LQMs/ QAPPs	Audits/ Responses	COC Documentation	Accounting
	QMP (Corporate)	Certifications	Contracts and Amendments	Corporate Safety Manual, Permits, Disposal Records
	SOPs	SDRs/RDRs	Correspondence	Employee Handbook
		Logbooks*	QAPP	Personnel files, Employee Signature & Initials, Training Records
		Method & Software Validation, Verification	SAP	
		Standards Certificates	Telephone Logbooks	Technical and Administrative Policies
	Work Instructions	MDL/IDL/IDC Studies	E-mails	
		PTs	Electronic Data Report	
		Statistical Evaluations		

*Examples of Logbook types: Maintenance, Instrument, Preparation (standard and samples), Standard and Reagent Receipt, Archiving, and Balance Calibration.

Table 5. STL Record Retention

Record Type		Archival Requirement *
Raw Data	All* (Electronic Data Reports (.pdf & EDD)	5 Years from completion
Controlled Documents	All*	5 Years from document retirement date
QC	All*	5 Years from archival
Project	All*	5 Years from project completion
Administrative	Personnel/Training	Indefinitely
	Accounting	10 years

* Exceptions listed in Table 6.

4.12.3 Programs with Longer Retention Requirements

Some regulatory programs have longer record retention requirements than the laboratory's standard record retention time. These are detailed in Table 6 with their retention requirements and

client-specific requirements are listed in the *Record Retention and Purging* SOP (UDM-002). In these cases, the longer retention requirement is implemented and noted in the archive. If special instructions exist such that client data cannot be destroyed prior to notification of the client, the container or box containing that data is marked as to who to contact for authorization prior to destroying the data.

Table 6. Special Record Retention Requirements

Program	Retention Requirement
Colorado – Drinking Water	10 years
Commonwealth of MA – All environmental data 310 CMR 42.14	10 years
FIFRA – 40 CFR Part 160	Retain for life of research or marketing permit for pesticides regulated by EPA
Massachusetts – Drinking Water	10 years
Michigan Department of Environmental Quality – all environmental data	10 years
Minnesota – Drinking Water	10 years
Navy Facilities Engineering Service Center (NFESC)	10 years
OSHA - 40 CFR Part 1910	30 years
Pennsylvania – Drinking Water	10 years

4.12.4 Archives and Record Transfer

Archives are indexed such that records are accessible on either a project or temporal basis. Archives are protected against fire, theft, loss, deterioration, and vermin. Electronic records are protected from deterioration caused by magnetic fields and/or electronic deterioration. Access to archives is controlled and documented.

STL ensures that all records are maintained as required by the regulatory guidelines and per this LQM upon facility location change or ownership transfer. Upon facility location change, all archives are retained by STL in accordance with this LQM. Upon ownership transfer, all final test reports generated by the laboratory will be submitted to the clients if not previously provided. Any further record retention requirements will be addressed in the ownership transfer agreement and the responsibility for maintaining archives is clearly established.

In the event that the laboratory is closed, all final test reports generated by the laboratory will be submitted to the clients if not previously provided. All records will then be transferred to STL's corporate record storage location. All boxes and contents will be appropriately labeled with the dates of destruction (Refer to Tables 5 and 6) and managed in accordance their policies.

4.13 Internal Audits

Quality assurance audits and surveillances are conducted to assess the performance of laboratory systems in meeting technical, regulatory and client requirements; and to evaluate the operational

details of the QA program (*Internal Audits*; UQA-013). They provide a means for management to be apprised of, and to respond to, a potential problem before it actually impacts the laboratory operations. They also are a mechanism for ensuring closure of corrective actions resulting from external audits.

4.13.1 Audit Types and Frequency

A number of types of audits are performed at STL. These audit types and frequency are categorized in Table 7.

Table 7. Audit Types and Frequency

Audit Type	Performed by	Frequency
Systems	QA Department or Designee	Annual
Data	QA Department	~5% of All Projects or As Needed
Special	QA Department or Designee	As Needed

4.13.2 Systems Audits

Systems audits are technical in nature and are conducted on an ongoing basis by the QA Manager or the QA Specialist. Systems audits cover all departments of the facility, both operational and support. The review consists of laboratory systems, procedures, documentation and issues noted in external audits.

The audit report is issued by the QA Manager or QA Specialist within 14 calendar days of the audit. The audit report is addressed to the department Section Manager and copied to the QA department and the Laboratory Manager.

Written audit responses are required within 21 calendar days of the audit report issue. A maximum of one calendar month is given to address any recommended corrective actions. The audit response is directed to all individuals copied on the audit report. Where a corrective action may require longer than a calendar month to complete, the target date for the corrective action implementation is stated and evidence of the corrective action is submitted to the QA Department in the agreed upon time frame.

4.13.3 Data Audits

Data audits are focused to assess the level of customer service, SOP compliance, regulatory compliance, accuracy and completeness of test results and reports, documentation, and adherence to established QC criteria, laboratory SOPs, technical policy, and project specific QC criteria.

The QA Department provides feedback and/or corrections and revisions to project reports where necessary. Records of the data audits are kept, and the frequency of data audits is included in the monthly QA report. In performing data audits, it is essential that data be assessed in terms of differentiating between systematic and isolated errors. Upon noting anomalous data or occurrences in the data audits, the QA Department is responsible for seeking clarification from the

appropriate personnel, ascertaining whether the error is systematic or an isolated error, and overseeing correction and/or revision of the project report if necessary. Errors found in client project reports are revised and the revision sent to the client (Section 4.8). The QA Department is also responsible for assisting in the corrective action process where a data audit leads to identification of the need for permanent corrective action.

The frequency of data auditing may also be dependent upon specific clients and regulatory programs. All active laboratory logbocks and QC files are subject to periodic audits/ surveillances by the QA personnel.

4.13.4 Special Audits

Special audits are conducted on an as needed basis, generally as a follow up to specific issues such as client complaints, corrective actions, proficiency testing results, data audits, systems audits, validation comments, or regulatory audits. Special audits are focused on a specific issue, and report format, distribution, and timeframes are designed to address the nature of the issue.

4.14 External Audits

STL is routinely audited by clients and external regulatory authorities – both government and non-government. Whether the audit is scheduled or unannounced, full cooperation with the audit team is provided by the laboratory and administrative staff. STL recommends that the audits be scheduled with the QA Department so that all necessary personnel are available on the day of the audit.

4.15 Management Reviews

4.15.1 QA Reports to Management

A monthly QA report is prepared by QA Manager and forwarded to the Laboratory Manager, Project Managers, Section (Technical) Managers and the Corporate Quality Director. The reports include statistical results that are used to assess the effectiveness of the quality system. The format of the monthly report is shown in Figure 3.

4.15.2 Quality Systems Management Review

A quality systems management review is performed at least annually by the QA Manager. This review ensures that the laboratory's quality system is adequate to satisfy the laboratory's policies and practices, government requirements, certification, accreditation, approval requirements, and client expectations. Quality systems management reviews are accomplished through the evaluation and revision of this LQM, monthly quality assurance reporting and goal setting.

Management reviews of specific quality system elements may be performed through continuous improvement activities, monthly QA reports, process changes, SOP revisions, and/or audit reports/responses. Documentation of these reviews are not required unless it is inherent in the review mechanism (e.g., approval signatures on SOP revisions).

Figure 3. Monthly QA Report Format

1. Audits
   External audits completed.
   External audits schedules.
   Internal system audits scheduled.
   Internal system audits completed.
      Significant or repeat deficiencies.
   Internal training record audits.
   Internal data audits.
      Significant or repeat deficiencies.

2. Revised Reports/Client Complaints
   Revised reports.
   Customer complaints.

3. Certification Changes
   Certification Status
   Certification Parameter List

4. Proficiency Testing (PT)
   Scores.
   Repeat failures and/or significant problems.
   PT Study status.

5. Miscellaneous QA and Operational Issues
   Standard Operating Procedure (SOP) status measurement.
   Preventive Actions.

6. QAPP/Project Review Status
   Report the activity of QAPP/Project review/writing activities.

5.0 Technical Requirements

5.1 Personnel

5.1.1 General

STL management believes that its highly qualified and professional staff is the single most important aspect in assuring the highest level of data quality and service in the industry. The staff consists of professionals and support personnel that include the following positions:

- Laboratory Manager
- QA Manager
- Health & Safety Coordinator / Waste Management
- Project Manager
- Information Technology Manager
- Department Section Manager (Technical Manager)

- Analyst
- Sample Custodian
- Technician
- Quality Assurance Specialist
- Data Review Specialist

In order to ensure that employees have sufficient education and experience to perform a particular task, job descriptions are developed for all personnel (Section 4.1.2).

5.1.2 Training

STL is committed to furthering the professional and technical development of employees at all levels. Selection of qualified candidates for laboratory employment begins with documentation of minimum education, training, and experience prerequisites needed to perform the prescribed task. Minimum education and training requirements for STL employees are outlined in Table 8.

Orientation to the laboratory's policies and procedures, in-house method training, and employee attendance at outside training courses and conferences all contribute toward employee proficiency. The QA section in conjunction with the Human Resources section are responsible for maintaining documentation of these activities.

Each laboratory section maintains documentation associated with analytical training (e.g., training records, document control). The QA department maintains [continued] method proficiency (e.g., MDLs, IDMPs, PT Sample Tracking, LCSs). This information is available to managers and staff for planning and evaluation.

Human Resources maintains documentation and attestation forms on employment status & records; benefit programs; timekeeping/payroll; and employee conduct (e.g., ethics). This information is maintained in the employee's secured personnel file.

Table 8. STL Employee Minimum Training Requirements

Specialty	Experience
General Chemistry and Instrumentation	Six months
Gas Chromatography	One year
Atomic Absorption	One year
Mass Spectrometry	One year
Spectra Interpretation	Two years

Required Training	Time Frame [1]	Employee Type
Environmental Health & Safety	Month 1	All
Quality Assurance	Quarter 1	All
Demonstration of Capability (DOC)	Prior to unsupervised method performance	Technical

[1] From the date of initial employment unless otherwise indicated.

When an analyst does not meet these requirements, they can perform a task under the supervision of a qualified analyst, peer reviewer or section manager, and are considered an analyst in training. The person supervising an analyst in training is accountable for the quality of the analytical data and must review and approve data and associated corrective actions.

DOCs are performed by the analysis of four replicate QC samples. Results of successive LCS analyses can be used to fulfill the DOC requirement. The accuracy and precision, measured as average recovery and standard deviation (using n-1 as the population), of the 4 replicate results are calculated and compared to those in the test method (where available). If the test method does not include accuracy and precision requirements, the results are compared to target criteria set by the laboratory. The laboratory sets the target criteria such that they reflect the DQOs of the specific test method or project. A DOC Certification Statement is recorded and maintained in the employee's training file. Tabulated results summary and raw data are completed and signed by the analyst and section manager with the proper entries made onto the analysts training record. The data is submitted to the QA department for entry into the master IDMP spreadsheet and filing. Figure 4 shows an example of a DOC Certification Statement.

Further details of the laboratory's training program are described in the Laboratory Training SOP (UQA-014).

5.1.3 Ethics Policy

Establishing and maintaining a high ethical standard is an important element of a Quality System. In order to ensure that all personnel understand the importance the company places on maintaining high ethical standards at all times; STL has established an Ethics Policy P-L-006 and an Ethics Agreement (Figure 5). Each employee signs the Ethics Agreement, signifying agreed compliance with its stated purpose.

Violations of this Ethics Policy will not be tolerated. Employees who violate this policy will be subject to disciplinary actions up to and including termination. Criminal violations may also be referred to the Government for prosecution. In addition, such actions could jeopardize the Company's ability to do work on Government contracts, and for that reason, the Company has a Zero Tolerance approach to such violations.

Ethics is also a major component of the QA training program. Each employee is trained in ethics within three months of hire in a QA training program that includes an overview of regulatory programs and program goals, a review of the ethics statement, and group discussions about data integrity and data misrepresentation. Employees are trained as to the legal and environmental repercussions that result from data misrepresentation. A data integrity hotline is maintained by STL and administered by the Corporate Quality Director.

Figure 4. Demonstration of Capability Certification Statement

Demonstration of Capability
Certification Statement

STL Chicago
2417 Bond Street
University Park, IL 60466

Analyst Name:_____
SOP No.:_____
Method No.:_____
Description:_____
Matrix:_____
Effective Date:_____

We the undersigned certify that:

1. The analyst identified above, using the cited test method(s), which is in use at this laboratory for the analyses of samples under the National Environmental Laboratory Accreditation Program, have met the Demonstration of Capability.
2. The test method(s) was performed by the analyst identified on this certification.
3. A copy of the reference method and laboratory-specific SOP(s) are available for all personnel on-site.
4. The data associated with the demonstration capability are true, accurate, complete and self-explanatory.
5. All raw data (including a copy of this certification form) necessary to reconstruct and validate these analyses have been retained at the laboratory, and that the associated information is well organized and available for review by authorized assessors.

Technical Manager	Signature	Date
Quality Manager	Signature	Date

Figure 5. STL Ethics Agreement (P-L-006)

I, _____(print name) understand that high standards of integrity are required of me with regard to the duties I perform and the data I report in connection with my employment at the Company. I agree that in the performance of my duties at the Company:

- *I will not intentionally report data values that are not the actual values obtained;*
- *I will not intentionally report the dates, times, sample or QC identifications, or method citations of data analyses that are not the actual dates, times, sample or QC identifications, or method citations;*
- *I will not intentionally misrepresent another individual's work; and*
- *If a supervisor or a member of STL management requests me to engage in or perform an activity that I feel is compromising data validity or quality, I will not comply with the request and report this action immediately to a member of the upper management, up to and including the president of Severn Trent Laboratories, Inc.*
- *I will not intentionally report data values that do not meet established quality control criteria as set forth in the Method and/or Standard Operation Procedures, or as defined by Company Policy.*
- *I agree to inform my Supervisor of any accidental reporting of non-authentic data by me in a timely manner. I agree to inform my Supervisor of any accidental or intentional reporting of non-authentic data by other employees. I have read this Ethics Agreement and understand that failure to comply with the conditions stated above will result in disciplinary action, up to and including termination from the Company.*

Compliance with this policy of business ethics and conduct is the responsibility of every STL employee. Disregard or failing to comply with this standard of business ethics and conduct will result in disciplinary action, up to and including termination of employment.

_____
EMPLOYEE'S NAME (printed)

_____
EMPLOYEE'S SIGNATURE

5.2 Facilities

The laboratory is a secure facility with controlled and documented access. Access is controlled by various measures including locked doors, electronic access cards, security codes, and a staffed reception area. All visitors sign in and are escorted by STL personnel while at the facility. The laboratory is locked at all times, unless a receptionist is present to monitor building access (e.g., between the hours of 8:00 a.m. and 5:00 p.m. Monday through Friday).

The facility is designed for efficient, automated high-quality operations. The laboratory is equipped with Heating, Ventilation, and Air Conditioning (HVAC) systems appropriate to the needs of environmental testing laboratories. Environmental conditions in the facility, such as hood flow, are routinely monitored and documented.

The facility is equipped with structural safety features. Each employee is familiar with the location, use, and capabilities of general and specialized safety features associated with their workplace. STL also provides and requires the use of protective equipment including safety glasses, protective clothing, gloves, etc..

5.3 Test Methods

Routine analytical services are performed using standard EPA-approved methodology. In some cases, modification of standard approved methods may be necessary to provide accurate analyses of particularly complex matrices.

5.3.1 Method Selection

Since numerous methods and analytical techniques are available, continued communication between the client and laboratory is imperative to assure the correct methods are utilized. Once client methodology requirements are established, this and other pertinent information is summarized by the Project Manager in a Technical Profile and within LabNets Project Notes feature. These mechanisms ensure that the proper analytical methods are applied when the samples arrive for log-in. For non-routine analytical services (e.g., special matrices, non-routine compound lists, etc..), the method of choice is selected based on client needs and available technology.

Most of the test methods performed at STL originate from test methods published by a regulatory agency such as the US EPA and other state and federal regulatory agencies. These include, but are not limited to, the following published compendiums of test methods. A listing of methods in which the laboratory is capable of performing is listed in laboratory's *Methods Capabilities* Work Instruction (CHI-22-09-255).

Guidelines Establishing Test Procedures for the Analysis of Pollutants Under the Clean Water Act, and Appendix A-C; 40 CFR Part 136, USEPA Office of Water.

Methods for Chemical Analysis of Water and Wastes, EPA 600 (4-79-020), 1983.

Methods for the Determination of Inorganic Substances in Environmental Samples, EPA-600/R-93/100, August 1993.

Methods for the Determination of Metals in Environmental Samples, EPA/600/4-91/010, June 1991. Supplement I: EPA-600/R-94/111, May 1994.

Methods for the Determination of Organic Compounds in Drinking Water, EPA-600/4-88-039, December 1988, Revised, July 1991, Supplement I, EPA-600-4-90-020, July 1990, Supplement II, EPA-600/R-92-129, August 1992.

NIOSH Manual of Analytical Methods, 4th ed., August 1994.

Statement of Work for Inorganics Analysis, ILM04.0, USEPA Contract Laboratory Program Multi-media, Multi-concentration.

Statement of Work for Organics Analysis, OLM04.2 and OLC02.1, USEPA Contract Laboratory Program, Multi-media, Multi-concentration.

Standard Methods for the Examination of Water and Wastewater, 18th/19th/20th edition; Eaton, A.D. Clesceri, L.S. Greenberg, A.E. Eds; American Water Works Association, Water Pollution Control Federation, American Public Health Association: Washington, D.C.

Test Methods for Evaluating Solid Waste Physical/Chemical Methods (SW-846), Third Edition, September 1986, Final Update I, July 1992, Final Update IIA, August 1993, Final Update II, September 1994; Final Update IIB, January 1995; Final Update III, December 1996.

Annual Book of ASTM Standards, American Society for Testing & Materials (ASTM), Philadelphia, PA.

The laboratory reviews updated versions to all the aforementioned references for adaptation based upon capabilities, instrumentation, etc.., and establishes an implementation schedule. As such, the laboratory strives to perform only the latest versions of each approved method.

5.3.2 SOPs

STL maintains an SOP Index (CHI-22-09-SOP List) for both Method and Process SOPs. Method SOPs are maintained to describe a specific test method. Process SOPs are maintained to describe function and processes not related to a analytical testing (e.g., administrative procedures).

Method SOPs contain the following information:

Title Page with Document Name, Document Number, Revision Number, Effective Date, Page Numbers and Total # of Pages, Authorized Signatures, Dates and Proprietary Information Statement (Figure 6).

1. Identification of Test Method
2. Applicable Matrix
3. Scope and Application, including test analytes
4. Summary of the Test Method
5. Reporting Limits
6. Definitions
7. Interferences
8. Safety
9. Equipment and Supplies
10. Reagents and Standards
11. Sample Collection, Preservation and Storage
12. Quality Control
13. Calibration and Standardization
14. Procedure
15. Calculations
16. Method Performance
17. Pollution Prevention
18. Data Assessment and Acceptance Criteria for Quality Control Measures
19. Corrective Actions for Out-of-Control Data
20. Contingencies for Handling Out-of-Control or Unacceptable Data
21. Waste Management
22. References
23. Tables, Diagrams, Flowcharts and Validation Data

Process SOPs contain the following information:

Title Page with Document Name, Document Number, Revision Number, Effective Date, Page Numbers and Total # of Pages, Authorized Signatures, Dates and Proprietary Information Statement (Figure 6).

1. Scope
2. Summary

3. Definitions
4. Responsibilities
5. Procedure
6. References
7. Tables, Diagrams, and Flowcharts

The QA Department is responsible for maintenance of SOPs, archival of SOP historical revisions, maintenance of an SOP index, and records of controlled distribution. SOPs, at a minimum, undergo annual review (12-18 months). Where an SOP is based on a published method, the laboratory maintains a copy of the reference method.

Figure 6. Proprietary Information Statement

SOP Change Form

The SOP Change Form is used for implementation, documentation, and authorization of changes to SOPs (*SOP Change Protocol*; UQA-032). Immediate changes in SOPs may be necessary to accommodate improvements; to implement acceptable changes in practices; or to correct potential errors in the existing version. The reason for the change will be identified and a detailed description of the procedure change will be presented. Since this form will become part of the referenced SOP, until such time that the SOP is updated, it must be legible and comprehensible. The Change Form must provide an exact description and identify the affected sections.

Once this form is completed and changes are authorized, it becomes an official part of the SOP for which it revises, and is subject to all document control and records management policies.

5.3.3 Method Validation

Laboratory developed methods are validated and documented according to the procedure described in Section 5.3.5.

5.3.4 Method Verification

Method verification is required when a validated standard test method or a method modification is implemented. The level of activity required for method verification is dependent on the type of method being implemented, or on the level of method modification and its affect on a method's robustness. Method modification often takes advantage of a method's robustness, or the ability to make minor changes in a method without affecting the method's outcome. Method verification may require some, but not all, of the activities described in Section 5.3.5.

5.3.5 Method Validation and Verification Activities

Before analyzing samples by a particular method, method validation and/or method verification must occur. A complete validation of the method is required for laboratory developed methods. While method validation can take various courses, the following activities can be required as part of method validation. Method validation records are designated QC records and are archived accordingly.

Determination of Method Selectivity
Method selectivity is demonstrated for the analyte(s) in the specific matrix or matrices. In some cases, to achieve the required selectivity for an analyte, a confirmation analysis is required as part of the method.

Determination of Method Sensitivity
Sensitivity can be both estimated and demonstrated. Whether a study is required to estimate sensitivity depends on the level of method development required when applying a particular measurement system to a specific set of samples. Where estimations and/or demonstrations of sensitivity are required by regulation or client agreement, such as the procedure in 40 CFR Part 136 Appendix B, under the Clean Water Act, these shall be followed. The laboratory determines MDLs are described in Section 4.4.3.6 and within UQA-017.

Relationship of Limit of Detection (LOD) to the Quantitation Limit (QL)
An important characteristic of expression of sensitivity is the difference in the LOD and the QL. The LOD is the minimum level at which the presence of an analyte can be reliably concluded. The QL is the minimum level at which both the presence of an analyte and its concentration can be reliably determined. For most instrumental measurement systems, there is a region where semi-quantitative data is generated around the LOD (both above and below the estimated MDL or LOD) and below the QL. In this region, detection of an analyte may be confirmed but quantification of the analyte is unreliable within the accuracy and precision guidelines of the measurement system. When an analyte is detected below the QL, and the presence of the analyte is confirmed by meeting the qualitative identification criteria for the analyte, the analyte can be reliably reported, but the amount of the analyte can only be estimated. If data is to be reported in this region, it must be done so with a qualification that denotes the semi-quantitative nature of the result.

Determination of Interferences
A determination that the method is free from interferences in a blank matrix is performed.

Determination of Range
Where appropriate, a determination of the applicable range of the method may be performed. In most cases, range is determined and demonstrated by comparison of the response of an analyte in a curve to established or targeted criteria. The curve is used to establish the range of quantitation and the lower and upper values of the curve represent upper and lower quantitation limits. Curves are not limited to linear relationships.

Demonstration of Capability
DOCs are performed prior to method performance.

Determination of Accuracy and Precision
Accuracy and precision studies are generally performed using replicate analyses, with a resulting percent recovery and measure of reproducibility (standard deviation, relative standard deviation) calculated and measured against a set of target criteria.

Documentation of Method
The method is formally documented in an SOP. If the method is a minor modification of a standard laboratory method that is already documented in an SOP, an SOP Appendix describing the specific differences in the new method is acceptable in place of a separate SOP.

Continued Demonstration of Method Performance
Continued demonstration of Method Performance is addressed in the SOP. Continued demonstration of method performance is generally accomplished by batch specific QC samples such as LCS and Method Blanks.

5.3.6 Data Reduction and Review

Analytical data are entered/downloaded directly into LabNet or recorded on pre-formatted bench sheets that are paginated and bound into laboratory logbooks. These logbooks are issued and controlled by the laboratory's QA Section. A unique document control code is assigned to each book to assure that chronological record keeping is maintained. Analytical data may be electronically stored as a secure .pdf file to which the analyst applies an electronic signature.

Analytical data is referenced to a unique sample identification number for internal tracking and reporting. Both LabNet entries and logbook pages contain the following information, as applicable: analytical method, analyst, date, sequential page number, associated sample numbers, standard concentrations, instrument settings, and raw data. Entries are in chronological order and maintained so as to enable reconstruction of the analytical sequence.

The analyst is responsible for entering / recording all appropriate information, and for signing and dating all logbook entries daily. All entries and logbook pages are reviewed for completeness by a supervisor, peer reviewer or the analyst themselves. Data review checklists document the analytical review of the LabNet entries, logbook and associated QC indicators. Copies of instrument outputs (chromatograms, mass spectra, etc..) are maintained on file or electronically with the analyst's signature/initials and date.

5.3.6.1 Data Reduction

The complexity of the data reduction depends on the analytical method and the number of discrete operations involved (e.g., extractions, dilutions, instrument readings and concentrations). The analyst calculates the final results from the raw data or uses appropriate computer programs to assist in the calculation of final reportable values.

For manual data entry, e.g., Wet Chemistry, the data is reduced by the analyst and then verified by the section manager or alternate analyst prior to updating the data in LabNet. The spreadsheets, or any other type of applicable documents, are signed by both the analyst and alternate reviewer to confirm the accuracy of the manual entry(s).

Manual integration of peaks will be documented and reviewed and the raw data will be flagged in accordance with the STL Corporate SOP entitled *Acceptable Manual Integration Practices* (S-Q-004).

Copies of all raw data and the calculations used to generate the final results, such as bound logbooks, are retained on file for a minimum of 5 years or as otherwise requested by the client/project.

Calculations and data reduction steps for various methods are summarized in the respective analytical SOPs or program requirements.

5.3.6.2 Data Review

All data, regardless of regulatory program or level of reporting, are subject to a thorough review process. The individual analyst continually reviews the quality of the data through calibration checks, quality control sample results and performance evaluation samples. Data review is initiated by the analyst during, immediately following, and after the completed analysis.

All levels of the review are documented on Data Review Checklists that are specific to each laboratory section (identified via Work Instruction numbers).

Primary Review

The primary review is often referred to as a "bench-level" review. In most cases, the analyst who generates the data (e.g., logs in, prepares and/or analyzes the samples) is the primary reviewer. In some cases, an analyst may be reducing data for samples run by an auto-sampler set up by a different analyst. In this case, the identity of both the analyst and the primary reviewer is identified in the raw data.

One of the most important aspects of primary review is to make sure that the test instructions are clear, and that all project specific requirements have been understood and followed.

Once an analysis is complete, the primary reviewer ensures, where applicable, that:

- Sample preparation information is complete, accurate, and documented.
- Calculations have been performed correctly.
- Quantitation has been performed accurately.
- Qualitative identifications are accurate.
- Manual integrations are appropriate.

- Data flags to indicate manual integrations are recorded.
- Manual integrations are authorized by a date and signature or initials of primary analyst.
- Client specific requirements have been followed.
- Method and process SOPs have been followed.
- Method QC criteria have been met.
- QC samples are within established limits.
- Dilution factors are correctly recorded and applied.
- Non-conformances and/or anomalous data have been properly documented and appropriately communicated.
- COC procedures have been followed.
- Primary review is documented by date and initials/signature of primary analyst.

Any anomalous results and/or non-conformances noted during the Primary Review are documented on the Data Review Checklist and on an SDR; and are communicated to the Section Manager and the Project Manager for resolution. Resolution can require sample reanalysis, or it may require that data be reported with a qualification. Non-conformances are documented per Section 4.9.

Secondary Review

The secondary review is also a complete technical review of a data and is performed by the Section Manager, analyst or data specialist. The secondary review is documented on the same Data Review Checklist as the primary review.

The following items are reviewed:

- Qualitative Identification
- Quantitative Accuracy
- Calibration
- QC Samples
- Method QC Criteria
- Adherence to method and process SOPs
- Accuracy of Final Client Reporting Forms
- Manual Integrations – Minimal requirement is to spot-check raw data files for manual integration, as verified by date and initials or signature of secondary data reviewer. Some regulatory programs require 100% secondary review of manual integrations.
- Completeness
- Special Requirements/Instructions

If problems are found during the secondary review, the reviewer must work with the appropriate personnel to resolve them. If changes are made to the data, such as alternate qualitative identifications, identifications of additional target analytes, re-quantitation, or re-integration, the secondary reviewer must contact the laboratory analyst and/or primary reviewer of the data so that the primary analyst and/or reviewer is aware of the appropriate reporting procedures.

Completeness Review

The completeness review includes the generation of a project narrative and/or cover letter which outlines anomalous data and non-compliances using project narrative notes and SDRs or CARs

(non-compliance reports) generated during the primary and secondary review. The completeness review addresses the following items:

- Is the project report complete?
- Does the data meet with the client's expectations?
- Were the data quality objectives of the project met?

Are QC outages and/or non-conformances approved and appropriately explained in the narrative notes?

The laboratory Section Manager(s), Data Management personnel and the Project Manager contribute to the completeness review.

5.3.7 Data Integrity and Security

This section details those procedures that are relevant to computer systems that collect, analyze, and process raw instrumental data, and those that manage and report data.

Security and Traceability

Access to the laboratory's LabNet system, STL's proprietary LIMS, that collects, analyzes, and processes raw instrumental data, and those that manage and report data is both controlled and recorded. System users are granted access levels that are commensurate with their training and responsibilities.

Control of the system is accomplished through limitation of access to the system by users with the education, training and experience to perform the task knowledgeably and accurately. System users are granted privileges that are commensurate with their experience and responsibilities.

Computer access is tracked by using unique login names and passwords for all employees that have access to the computer system. Entries and changes are documented with the identity of the individual making the entry, and the time and date. Where a computer system is processing raw instrumental data, the instrument identification number as described in Section 5.4.1 is recorded. The system has the capability of maintaining audit trails to track entries and changes to the data. This function is activated on any computer system that has that capability (e.g., Target).

Verification

All the LabNet software programs have been verified prior to use and prior to the implementation of any version upgrades. Verification involves assessing whether the computer system accurately performs its intended function. Verification generally is accomplished by comparing the output of the program with the output of the raw data manually processed, or processed by the software being replaced. All records of the verification are retained as QC records.

Validation

Software validation involves documentation of specifications and coding as well as verification of results. Software validation is performed on all in house programs. Records of validation include original specifications, identity of code, printout of code, software name, software version, name of individual writing the code, comparison of program output with specifications, and verification records as specified above. Records of validation are retained as QC records.

Auditing
STLs LabNet System Managers continually review the control, security, and tracking of IT systems and software.

Version Control
The laboratory maintains copies of outdated versions of software and associated manuals for all software in use at the laboratory for a period of 5 years from its retirement date. The associated hardware, required to operate the software, is also retained for the same time period.

5.4 Equipment

5.4.1 Equipment Operation

STL is committed to routinely updating and automating instrumentation. The laboratory maintains state of the art instrumentation to perform the analyses within the QC specifications of the test methods. The laboratory maintains an Equipment Tracking Form (CHI-22-09-068) for each piece of equipment and instrumentation that documents the following information:

- Identity
- Date In Service
- Manufacturer's Name, Model Number, Serial Number
- Current Location
- Preventative Maintenance Schedule

All equipment is subject to rigorous checks upon its receipt, upgrade, or modification to establish that the equipment meets with the selectivity, accuracy, and precision required by the test method for which it is to be used. All manufacturer's operations and maintenance manuals are kept up to date and accessible for the use of the equipment operator. Documentation of equipment usage is maintained using analytical run and maintenance logbooks.

5.4.2 Equipment Maintenance

STL employs a system of preventative maintenance in order to ensure system up time, minimize corrective maintenance costs and ensure data validity. All routine maintenance is performed as recommended by the manufacturer and may be performed by an analyst, instrument specialist or outside technician. Maintenance logbooks are kept on all major pieces of equipment in which both routine and non-routine maintenance is recorded.

Any item of equipment or instrumentation that has been subjected to overloading or mishandling, provides suspected results, has been shown by verification or otherwise to be defective, is new or not been used for an extended period of time, is taken out of services and tagged as "DO NOT USE INSTRUMENT". The tag is signed/dated by the person removing the item from service and noted as to the reason of in-operation *(Instrument and Equipment Out-of-Service Tagging*; UQA-012).

Any instrumentation that is brought back on-line must have MDLs and DOCs performed and have acceptance within prescribe criteria; or calibrated by a certified agency (e.g., balances or Class S

weights) and tagged as being within calibration specifications; and proven to provide consistent measurements (e.g., refrigerators, eppendorf pipettes, ovens).

The return to analytical control following instrument repair is documented in the maintenance logbook. Maintenance logbooks are retained as QC records. Notation of the date and maintenance activity is recorded each time service procedures are performed. Maintenance logbooks are retained as QA records.

Maintenance contracts are held on specific pieces of equipment where outside service is efficient, cost-effective, and necessary for effective operation of the laboratory. Table 9 lists STL's major equipment and the suggested maintenance procedures.

Table 9. Major Equipment Maintenance

Instrument	Procedure	Frequency
AA (Graphite Furnace)	Clean lens and furnace head	Daily
	Replace windows	As required
	Check or change cuvette	Daily
	Check & drain compressor drain	Daily
	Clean atomizer cell/furnace hood	Daily
	Nebulizer cleaned/dried	Weekly or as required
	Check/change marble stones	Weekly
	Clean filters	Weekly
	Change graphite tube/platform	As required
	Empty waste container	Daily
	Remove carbon tube and check wear	Daily
	Check sample introduction probe	Daily
Leeman Mercury Analyzer	Check tubing for wear	Daily
	Fill rinse tank with 10% HCl	Daily
	Insert clean drying tube filled with Magnesium Perchlorate	Daily
	Fill reductant bottle with 10% Stannous Chloride	Daily
ICP	Check pump tubing	Daily
	Check liquid argon supply	Daily
	Check fluid level in waste container	Daily
	Check filters	Weekly
	Clean or replace filters	As required
	Check torch	Daily
	Check sample spray chamber for debris	Monthly
	Clean and align nebulizer	Monthly
	Check entrance slit for debris	Monthly
	Change printer ribbon	As required
	Replace pump tubing	As required

Table 9. Major Equipment Maintenance

Instrument	Procedure	Frequency
UV-Vis Spectrophotometer	Clean ambient flow cell	As required
	Precision check/alignment of flow cell	As required
	Wavelength verification check	Semi-annually
Auto Analyzers	Clean sampler	Daily
	Check all tubing	Daily
	Clean inside of colorimeter	Daily
	Clean pump well and pump rollers	Quarterly
	Clean wash fluid receptacle	Weekly
	Oil rollers/chains/side rails	Weekly
	Clean optics and cells	Quarterly
Hewlett Packard GC/MS	Ion gauge tube degassing	As required
	Pump oil-level check	Monthly
	Pump oil changing	Semi-annually
	Analyzer bake-out	As required
	Analyzer cleaning	As required
	Resolution adjustment	As required
	COMPUTER SYSTEM AND PRINTER:	
	Air filter cleaning	As required
	Change data system air filter	As required
	Printer head carriage lubrication	As required
	Paper sprocket cleaning	As required
	Drive belt lubrication	As required
Gas Chromatograph	Compare standard response to previous day or since last initial calibration	Daily
	Check carrier gas flow rate in column	Daily via use of known compound retention
	Check temp. of detector, inlet, column oven	Daily
	Septum replacement	As required
	Glass wool replacement	As required
	Check system for gas leaks with SNOOP	W/cylinder change as required
	Check for loose/frayed wires and insulation	Monthly
	Visually check for shifting of column packing material resulting in forward movement beyond the bottom of the column exit or settling in excess of 1/2" from the glass wool plug at the column inlet	As needed
	Bake injector/column	As Required
	Change/remove sections of guard column	As Required
	Replace connectors/liners	As Required
	Change/replace column(s)	As Required

Table 9. Major Equipment Maintenance

Instrument	Procedure	Frequency
Electron Capture Detector (ECD)	Detector wipe test (Ni-63) Detector cleaning	Semi-annually As required
Flame Ionization Detector (FID)	Detector cleaning	As required
Photoionization Detector (PID)	Change O-rings Clean lamp window	As required As required
HPLC	Change guard columns Change lamps Change pump seals Replace tubing Change fuses in power supply Filter all samples and solvents Change autosampler rotor/stator	As required As required Semi-annually or as required As required As required Daily As required
Balances	Class "S" traceable weight check Clean pan and check if level Field service	Daily, when used Daily At least Annually
Conductivity Meter	0.01 M KCl calibration Conductivity cell cleaning	Daily As required
Turbidimeter	Check light bulb	Daily, when used
Deionized/Distilled Water	Check conductivity Check deionizer light Monitor for VOA's System cleaning Replace cartridge & large mixed bed resins	Daily Daily Daily As required As required
Drying Ovens	Temperature monitoring Temperature adjustments	Daily As required
Refrigerators/ Freezers	Temperature monitoring Temperature adjustment Defrosting/cleaning	Daily As required As required
Vacuum Pumps/ Air Compressor	Drained Belts checked Lubricated	Weekly Monthly Semi-annually
pH/Specific Ion Meter	Calibration/check slope Clean electrode	Daily As required
BOD Incubator	Temperature monitoring Coil and incubator cleaning	Daily Monthly
Centrifuge	Check brushes and bearings	Every 6 months or as needed

Table 9. Major Equipment Maintenance

Instrument	Procedure	Frequency
Water baths	Temperature monitoring Water replaced	Daily Monthly or as needed

5.4.3 Equipment Verification and Calibration

All equipment is calibrated prior to use (Initial Calibration) to establish its ability to meet the QC guidelines contained in the test method for which the instrumentation is to be used. All sample measurements are made within the calibrated range of the instrument and in compliance with method requirements. The calibration data, which includes instrument conditions and standard concentrations, is documented in pre-formatted instrument runlogs or within LabNet itself. The preparation of all reference materials used for calibration is documented via LabNet.

Once an instrument is calibrated, ongoing instrument calibration is demonstrated (Continuing Calibration) at the appropriate frequency as defined in the test method. Refer to the STL Corporate Policy *Selection of Calibration Points* (P-T-001), for guidance on using calibration data. Any instrument that is deemed to be malfunctioning is clearly marked and taken out of service. When the instrument is brought back into control, acceptable performance is documented.

5.4.3.1 Instrument Calibration

Specific instrument calibration procedures for various instruments are summarized further in this section, and detailed in the respective analytical methods. Typically, more than one analytical method is available for an analysis. These various methods and other program requirements (e.g., U.S. EPA CLP, AFCEE, NFESC, USACE, QAPPs, contracts, etc..) may specify different calibration requirements. Therefore, calibration details as specified in the respective laboratory SOPs, Technical Profiles, QAPP, program requirements, and contracts supersede the general instrument calibration procedures are described further in Table 10. Complete details are provided in each method SOP.

Table 10. Minimum Instrument Calibration Procedures

Technique	Activity	Minimum Requirements
Metals (ICAP)	Initial Calibration	Following a period of time sufficient to warm up the instrument, the ICP is calibrated prior to each analytical run or minimally every 24 hours. Calibration standards are prepared from reliable reference materials and contain all metals for which analyses are being conducted. Working calibration standards are prepared fresh daily. Quarterly, multi-concentration calibration is performed to document linearity. On a day-to-day basis, 4 calibration standards (blank, high standard, 50% standard, and 20% standard) are analyzed. Prior to an analytical run, the instrument is calibrated using three standards. An Initial Calibration Verification (ICV) standard is analyzed immediately after standardization, followed by an Initial Calibration Blank (ICB). The ICV is from a source other than that used for initial calibration and the ICB must be free of target analytes at and above the value to be reported or appropriate corrective action must be taken. ICP Interference Check Samples (ICSA/ICSAB) are analyzed at the frequency described in each method SOP.
	Continuing Calibration	The initial calibration is verified during the analysis sequence by analysis of a Continuing Calibration Verification (CCV) standard and a Continuing Calibration Blank (CCB). The response of the CCV must be within the SOP-specified criteria (e.g., ± 10% recovery of the true value). The CCB must be free of target analytes at or above the value to be reported or appropriate corrective action must be taken. If any ICVs/CCVs or blanks exceed their acceptance criteria, appropriate corrective action must be taken.
Atomic Absorption (GFAA/CVAA)	Initial Calibration	Initial calibration will include analysis of a calibration blank and a minimum of four (4) calibration standards covering the anticipated range of measurement. Duplicate injections are made for each concentration. Response readings, e.g., absorbance, are recorded and the resultant standard calibration curve calculated. If the SOP or program-specified criteria are not met, appropriate corrective action must be taken. An ICV standard will be analyzed immediately after standardization. The ICV must be within SOP-specified criteria (e.g., ±5% of the true value for drinking water, and ±10% in most other cases), or the initial calibration must be repeated. The ICV must be from a source other than that used for initial calibration. An ICB will be analyzed after the ICV. The ICB must be free of target analytes at and above a concentration in which sample results are reported, or corrective action must be taken.

Table 10. Minimum Instrument Calibration Procedures

Technique	Activity	Minimum Requirements
Atomic Absorption (GFAA/CVAA) (cont'd.)	Continuing Calibration	The initial calibration is verified during the analysis sequence by evaluation of a CCV standard and a CCB, as described above. The CCV value must be within SOP-specified criteria (e.g., ±10% recovery of the true value except for mercury within ±20 % of the true value). The CCB must be free of target analytes at and above the concentration reported in samples. If any ICVs/CCVs or blanks exceed their acceptance criteria, corrective action must be taken.
Inorganic Colorimetric Methods	Initial Calibration	A full initial standard calibration curve will be prepared for all colorimetric analyses on a daily basis. Working standards to define this curve will include a minimum of five (5) concentrations which cover the anticipated range of measurement, plus a calibration blank. At least one of the calibration standards will be at a concentration which will enable verification of instrument response near the reporting limit as defined in Section 8.6 or a level suitable for meeting specific program requirements. The requirement for an acceptable initial calibration is described in the analytical SOP. If the criteria are not met, appropriate corrective action must be taken. Calibration data, e.g., correlation coefficient, is entered into the laboratory notebook, or associated instrument printouts, and retained with the sample data. In lieu of a full initial curve, a daily calibration verification may be analyzed. This daily calibration will at a minimum consist of a blank and a mid-range standard. Results must be within SOP-specified criteria. If not, reanalysis of the standards may be done once to verify the readings; otherwise, a new curve will be developed. For procedures that require pretreatment steps, a minimum of one standard shall be prepared with the pretreatment. If the pre-treated standard is within SOP-specified criteria, the curve will be used. If the pre-treated sample is not within the criteria, the reason will be determined. If it is determined that the difference between the curves is inherent in the procedure, the curve will be based on the standards prepared and carried through the pretreatment. An ICV will be analyzed immediately after the standardization, followed by an ICB. The ICV must be from a source other than that used for initial calibration. The ICV must be within SOP-specified criteria and the ICB must be free of target analytes or appropriate corrective action must be taken.
	Continuing Calibration	The initial calibration is verified during the analysis sequence by analysis of a CCB and a CCV. If any ICVs/CCVs or blanks exceed their acceptance criteria, analysis is terminated, and the instrument is recalibrated. All samples since the last valid calibration verification are reanalyzed.

Table 10. Minimum Instrument Calibration Procedures

Technique	Activity	Minimum Requirements
Ion Chromatography	Initial Calibration	The ion chromatograph will be calibrated prior to each day of use. Calibration standards will be prepared from appropriate reference materials and will include a blank and a minimum of three concentrations to cover the anticipated range of measurements. At least one of the calibration standards will be at a concentration which will enable verification of instrument response near the reporting limit. If SOP-specified calibration criteria cannot be achieved, appropriate corrective action must be taken. Calibration data, e.g., correlation coefficient, will be archived with sample raw data.
	Continuing Calibration	A continuing calibration standard and blank will be analyzed at a frequency of 10% and at the end of the analysis shift. The response calculated as a percent recovery of the standard must meet SOP or program-specific criteria. The response of the blank must be less than the concentration to be reported for samples analyzed.
GC/MS	All GC/MS instrumentation is calibrated to set specifications prior to sample analysis. These specifications vary depending on the requirements of the analytical program and the designated analytical method.	
	Tuning and Mass Calibration	Mass spectrometers are calibrated with perfluorotributylamine (FC-43) or perfluorophenanthrene (FC- 5311) as required to ensure correct mass assignment. In addition, at the beginning of the daily work shift, the GC/MS system must be tuned with decafluorotriphenylphosphine (DFTPP) for semivolatiles analysis and 4-bromofluorobenzene (BFB) for volatiles analysis, and calibrated to target compounds. The majority of the laboratory work utilizes U.S. EPA-CLP or SW-846 protocols, which define the work shift as a 12-hour period initiated by the injection of DFTPP, BFB, or the dioxin/furan window mix. For drinking water programs (500 series methods), a 12-hour work shift is specified in the method for calibration frequency. For wastewater programs (600 series methods); the tune expires when the day's analytical sequence is complete; however, no time limit is given for the length of the daily GC/MS work shift. Ion abundances will be within the windows dictated by the specific program requirements.

Table 10. Minimum Instrument Calibration Procedures

Technique	Activity	Minimum Requirements
GC/MS (cont'd.)	Initial Calibration	After an instrument has been tuned, initial calibration curves (generally 3-5 points) are generated for the compounds of interest. The low level standard must be at a concentration which will enable verification of instrument response near the reporting limit or at a concentration acceptable to meet program requirements. The other standards must extend through the linear working range of the detector. The parameters requiring quantitation must meet SOP or program-specified criteria prior to initiation of sample analysis. Any sample extracts containing parameters of interest which exceed the concentration of the high level standard, must be diluted to bring the parameters within the range of the standards. Instrument response to these target compounds are evaluated against SOP-specified criteria. Linearity is verified by evaluating the response factors (RF) for the initial calibration standards against SOP-specified criteria. Once an acceptable calibration is obtained, samples may be analyzed up until the expiration of the tune. At that time, the instrument must be re-tuned prior to further analysis. After acceptable tuning, a continuing calibration standard may be analyzed in lieu of a full multi-point calibration if the SOP-specified criteria are met. The majority of compounds analyzed for GC/MS comprise EPA's Target Compound List (TCL) or Priority Pollutant List (PPL). For add-on compounds not on the current TCL or PPL, initial calibration may be performed using a single point calibration of the additional compound(s), unless prior arrangements are made for a full three-to-five point calibration. Calibration data, to include linearity verification, will be maintained in the laboratory's records of instrument calibrations.
	Continuing Calibration	During each operating shift, a single calibration standard may be analyzed to verify that the instrument responses are still within the initial calibration determinations, as defined in the specific SOPs. If criteria cannot be met, appropriate corrective action must be taken.
GC and HPLC	Gas chromatographs and high performance liquid chromatographs will be calibrated prior to use as described in analytical SOP or program requirements. Calibration standard mixtures will be prepared from appropriate reference materials and will contain analytes appropriate for the method of analysis or program requirements	
	Initial Calibration	Initial calibration will include three to five calibration standards covering the anticipated range of measurement. The low level standard must be at a concentration which will enable verification of instrument response near the reporting limit or at a concentration acceptable to meet program requirements. The other standards must extend through the linear working range of the detector. The parameters requiring quantitation must meet SOP or program-specified criteria prior to initiation of sample analysis. Any sample extracts containing parameters of interest which exceed the concentration of the high level standard, must be diluted to bring the parameters within the range of the standards.

Table 10. Minimum Instrument Calibration Procedures

Technique	Activity	Minimum Requirements
GC and HPLC (cont'd.)	Continuing Calibration	The response of the instrument will be verified for each analysis sequence by evaluation of a daily calibration verification standard at a mid-range concentration. In order to demonstrate that the initial calibration curve is still valid, the calibration check standard must be within SOP or program-specified acceptance criteria for the compounds of interest or the instrument must be recalibrated. For multi-analyte methods, this check standard may contain a representative number of target analytes rather than the full list of target compounds. Optionally, initial calibration (e.g., the full range of concentration levels) can be performed at the beginning of the analysis sequence. Within the analysis sequence, instrument drift will be monitored by analysis of a mid-range calibration standard every ten samples or 12 hour sequence (depending on the method protocol), including external QC. If the SOP or program-specified calibration criteria are not met for the compounds of interest, appropriate corrective action must be taken.

5.5 Measurement Traceability

5.5.1 General

Traceability of measurements is assured using a system of documentation, calibration, and analysis of reference standards. Laboratory equipment that are peripheral to analysis and whose calibration is not necessarily documented in a test method analysis or by analysis of a reference standard is subject to ongoing certifications of accuracy.

At a minimum, these include procedures for checking specifications for balances, thermometers, temperature, De-ionized (DI) and Reverse Osmosis (RO) water systems, automatic/eppendorf pipettes and other volumetric measuring devices. Wherever possible, subsidiary or peripheral equipment is checked against standard equipment or standards that are traceable to national or international standards [with the exception of class A glassware (including glass microliter syringes that have a certificate of accuracy)].

An external certified service engineer services laboratory balances on an annual basis. This service is documented on each balance with a signed and dated certification sticker. Balances are calibrated on each day of use (*Balance Calibration, Care and Use*; UQA-003). All thermometers and temperature monitoring devices are calibrated annually against a traceable reference thermometer. Temperature readings of ovens, refrigerators, and incubators are checked on each day of use (*Thermometer Calibrations*; UQA-034).

Laboratory DI and RO water systems have documented preventative maintenance schedules and the conductivity of the water is recorded on each day of use (*Water Quality*; UQA-035).

5.5.2 Reference Standards

The receipt of all reference standards is documented in LabNet. Standards are obtained from commercial vendors and sources may vary depending upon the availability of mixes and solutions from vendors. Each production unit is responsible to ensure, when available, that all standards are traceable to EPA, NIST, A2LA, SARMs and are accompanied by a Certificate of Analysis that documents the standard purity. If a standard cannot be purchased from a vendor that supplies a Certificate of Analysis, the purity of the standard is documented by analysis.

The receipt of each dry chemical, purchased stock solution or reference material to be used as a standard is assigned a unique ID number. The chemical name, manufacturer, lot number, date received, expiration date, date opened and initials of the analyst who opened the chemical are documented. The expiration dates for ampulated solutions shall not exceed the manufacturer's expiration date. Expiration dates for laboratory-prepared stock and diluted standards shall be no later than the expiration date of the stock solution or material or the date calculated from the holding time allowed by the applicable analytical method, whichever comes first. Expiration dates for pure chemicals shall be established by the laboratory and be based on chemical stability, possibility of contamination, and environmental and storage conditions. Expired standard materials shall be either revalidated prior to use or discarded. Revalidation may be performed through assignment of a true value and error window statistically derived from replicate analyses of the material as compared to an unexpired standard. The laboratory labels all standard and QC materials with expiration dates.

The preparation of all daughter solutions, whether a single or multiple-component stock, intermediate, or working standard solution, is documented in a standard solution preparation logbook, in a designated section of the analytical logbook or in the LabNet systems reagent program. This documentation references the Standard ID of the respective parent solution(s) used in its preparation, providing a solid trail back to the solution or chemical received from the vendor. These records include the standard name, final volume, matrix, final concentration, analyst initials, prep date and expiration date. A daughter solution should not have an expiration date which post-dates any of the parent solutions used in its preparation.

References standards are labeled with a unique Standard Identification Number, date received, and the expiration date. All documentation received with the reference standard or documentation of standard purity is retained as a QC record and references the Standard Identification Number. All efforts are made to purchase standards that are $\geq$ 97.0% purity. If this is not possible, the purity is used in performing standards calculations.

The accuracy of calibration standards is checked by comparison with a standard from a second source. In cases where a second standard manufacturer is not available, a different lot is acceptable for use as a second source. The appropriate QC criteria for specific standards are defined in laboratory SOPs. In most cases, the analysis of an ICV or LCS is used as the second source confirmation.

Storage conditions, such as shelf life, ambient or chilled, controlled or restricted access, wet or desiccated, etc.., are in conformance with the specifications set in the associated method, the program requirements, or the manufacturer's recommendation, as appropriate.

5.5.3 Reagents

Reagents are, in general, required to be analytical reagent grade unless otherwise specified in method SOPs. Reagents must be, at a minimum, the purity required in the test method. The date of reagent receipt, date the reagent was opened, and the date of reagent preparation (where applicable) are documented in LabNet for reagent traceability.

5.6 Sampling

Sample representativeness and integrity are the foundations upon which meaningful analytical results rely. Where documented and approved SAPs and/or QAPPs are in place, they must be made available to the laboratory before sample receipt, and approved by laboratory management before sample receipt.

5.7 Sample Handling, Transport, and Storage

5.7.1 General

COC can be established either when bottles are sent to the field, or at the time of sampling. STL can provide all of the necessary coolers, reagent water, sample containers, preservatives, sample labels, custody seals, COC forms, ice, and packing materials required to properly preserve, pack, and ship samples to the laboratory. Complete details for sample container preparation are contained within UCM-001. A summary of sample receipt is as follows with complete details available within the *Sample Receipt and Handling* SOP (USR-001).

Samples are received at the laboratory by the designated sample custodians and a unique LabNet job (batch) number is assigned. The following information is recorded for each sample shipment:

- Client/Project Name.
- Date and Time of Laboratory Receipt.
- Laboratory Job Number
- Signature or initials of the personnel receiving the cooler and making the entries.

Upon inspection of the cooler and custody seals, the sample custodian opens and inspects the contents of the cooler, and records the cooler temperature. If the cooler arrival temperature exceeds the required or method specified temperature range by $\pm 2^{\circ}C$ (for samples with a temperature requirement of $4^{\circ}C$, a cooler temperature of just above the water freezing temperature to $6^{\circ}C$ is acceptable); sample receipt is considered "compromised" and the procedure described in Section 4.7.1 is followed. All documents are immediately inspected to assure agreement between the test samples received and the COC.

Any non-conformance, irregularity, or compromised sample receipt as described in Section 4.7.1 is documented in an SDR and brought to the immediate attention of the Project Manager for resolution with the client. The COC, shipping documents, documentation of any non-conformance, irregularity, or compromised sample receipt, record of client contact, and resulting instructions become part of the permanent project record.

Samples that are being tested at another STL facility or by an external subcontractor are repackaged, iced, and sent out under COC.

Following sample labeling as described in Section 5.7.2, the sample is placed in storage. Refrigerated storage coolers are maintained at 4 ± 2°C. The temperature is monitored 4 times daily by an electronic monitoring software program. All samples are stored according to the requirements outlined in the test method, and in a manner such that they are not subject to cross contamination or contamination from their environment.

Access to the laboratory is restricted to laboratory personnel or escorted guests as described in Section 5.2. Therefore, once sample possession is relinquished to the laboratory, the sample is in a designated secure area (e.g., the laboratory facility) accessible only to authorized personnel. Locked storage coolers are available for protocol (e.g., AFCEE and CLP) that require internal COC procedures.

5.7.2 Sample Identification and Traceability

The sample custodian organizes the sample containers, COCs, and all pertinent information associated with the samples. The sample identity is verified against all associated sample information. Any inconsistencies are documented via an SDR and forwarded to the Project Manager for resolution with the client prior to identifying the sample(s) into LabNet.

Each sample container is assigned a unique Sample Identification Number that is cross-referenced to the client identification number such that traceability of test samples is unambiguous and documented. Each sample container is affixed with a durable sample identification label.

All unused portions of samples, including empty sample containers, are returned to the secure sample control area.

5.7.3 Sub-Sampling

Taking a representative sub-sample from a container containing a soil or solid matrix is necessary to ensure that the analytical results are representative of the sample collected in the field. The size of the sample container, the quantity of sample fitted within the container, and the homogeneity of the sample need consideration when sub-sampling for sample preparation.

After thoroughly mixing the sample within the sample container or transfer to a wip bag (or other suitable plastic bag), a sub-sample from various quadrants and depths of the sample are taken to acquire the required sample weight. Any non-homogenous looking material is avoided and noted as such within the sample preparation record.

5.7.4 Sample Preparation

Sample preparation procedures vary for each matrix and analytical method are as referenced in the laboratory SOPs.

5.7.5 Sample Disposal

Samples are retained in STL storage facilities for 30 days after the project report is sent unless prior written arrangements have been made with the client. Samples may be held longer or returned to the client per written request. Unused portions of samples are disposed of in accordance with federal, state and local regulations. Complete details on the disposal of samples, digestates, and extracts is available within the *Laboratory Waste Disposal Procedures* SOP (UWM-001).

5.8 Assuring the Quality of Test Results

5.8.1 Proficiency Testing

The laboratory analyzes Proficiency Test (PT) samples as required for accreditation and as outlined in NELAC. The laboratory participates in the PT program semi-annually for each PT field of testing for which it is accredited, according to the NELAC PT field of testing published guidelines. This includes drinking water, wastewater and solid/soil matrices.

The laboratory also participate in the Navy and Army Corps of Engineers Laboratory Assessment programs upon revalidation.

PT samples are handled and tested in the same manner (procedural, equipment, staff) as environmental samples. Results of PT samples are distributed to the laboratory line management for review and action, if required. Any required response to deficiencies are submitted to the QA department for review and are filed with the PT study records. PT test sample data is archived using the requirements for project and raw data record retention.

5.8.1.1 Double Blind Performance Evaluation

The laboratory participates in an annual double blind performance evaluation study. An external vendor is contracted to submit double blind samples to the laboratory. Both the level of customer service and the accuracy of the test results are assessed objectively by the external contractor, who provides a detailed report to the Corporate Quality Director and to the laboratory. This is administered as a double blind program in order to assess all facets of the laboratory's operations.

5.8.2 Control Samples

Control samples (e.g., QC indicators) are analyzed with each batch of samples to monitor laboratory performance in terms of accuracy, precision, sensitivity, selectivity, and interferences. Control samples must be uniquely identified and correlated to unique batches. Control samples further evaluate data based upon (1) Method Performance, which entails both the preparation and measurement steps; and (2) Matrix Effects, which evaluates field sampling accuracy, precision, representativeness, interferences, and the effect of the matrix on the method performed. Each regulatory program and each method within those programs specify the control samples that are prepared and/or analyzed with a specific batch.

Control sample types and typical frequency of their application are outlined Sections 5.8.2.1 through 5.8.2.5 and Tables 11 through 15. Note that frequency of control samples vary with

specific regulatory, methodology and project specific criteria. Complete details on method and regulatory program control samples are as listed in Sections 7 and 8 of each method SOP.

5.8.2.1 Method Performance Control Samples: Preparation Batch

Sample preparation or pre-treatment is commonly required before analysis. Typical preparation steps include homogenization, grinding, solvent extraction, sonication, acid digestion, distillation, reflux, evaporation, drying and ashing. During these pre-treatment steps, samples are arranged into discreet manageable groups referred to as preparation (prep) batches. Prep batches provide a means to control variability in sample treatment.
Control samples are added to each prep batch to monitor method performance (Table 11) and are processed through the entire analytical procedure with investigative/field samples.

Table 11. Preparation Batch Control Samples

Control Sample Type	Details	
Method Blank (MB)	Use	Monitors for potential contamination introduced during the sample preparation and analytical processes.
	Typical Frequency [1]	1 per batch of ≤ 20 samples per matrix type per sample extraction or preparation method.
	Description	Organics: Laboratory pure water for water samples or a purified solid matrix for soil or solid samples (when available or when requested); solid matrices commonly include sodium sulfate, vendor or agency supplied soil or solid, or purchased sand; these solids may require purification at the laboratory prior to use. Inorganics: Laboratory pure water for both water and soil or sediment samples. Volume/weights are selected to approximately equal the typical sample volume/weight used in sample preparation; and final results in a soil/solid batch may be calculated as mg/kg or ug/kg, assuming 100% solids and a weight equivalent to the aliquot used for the corresponding field samples, to facilitate comparison to actual field samples.
Laboratory Control Sample (LCS)	Use	Measures the accuracy of the method in a blank matrix and assesses method performance independent of potential field sample matrix affects.
	Typical Frequency [1]	1 per batch of ≤ 20 samples per matrix type per sample extraction or preparation method. For multi-analyte methods, the LCS may consist of surrogates in the blank matrix, and or a representative selection of target analytes/internal standards.
	Description	Prepared from a reference source of known concentration and processed through the preparation and analysis steps concurrently with the field samples. Aqueous LCS's may be processed for solid matrices unless a solid LCS is requested; final results may be calculated as mg/kg or ug/kg, assuming 100% solids and a weight equivalent to the aliquot used for the corresponding field samples, to facilitate comparison with the actual field samples.

Table 11. Preparation Batch Control Samples

Control Sample Type	Details	
Known QC Sample	Use	Comply with regulatory requirements; check the accuracy of an analytical procedure; troubleshoot method performance problems; verify an analyst in training's ability to accurately perform a method; to verify the return-to-control after method performance problems; and may also be used as an LCS.
	Typical Frequency [1]	As defined by the client or QAPP.
	Description	Obtained from outside suppliers or agencies; generally require preparation from concentrated materials by dilution into a standard matrix; contain known analytes or compounds; acceptance limits are provided by the vendor.

[1] Denotes an STL required frequency.

Field blanks, equipment blank and trip blanks, when received, are analyzed in the same manner as other field samples. However, a field blank should not be selected for matrix QC, as it does not provide information on the behavior of the target compounds in the field samples. Usually, the client sample ID will provide information to identify the field blanks with labels such as "FB", "EB", or "TB".

5.8.2.2 Method Performance Control Samples: Matrix

Matrix control samples include sample duplicates (MD), sample matrix spikes (MS), and sample surrogate spikes. These control samples help monitor for potential physical and chemical effects which may interfere with the precision and/or accuracy of the selected analytical method. Since interferences can enhance or mask the presence of target analytes, matrix control samples measure the degree of interference and are used to assist in the interpretation of the analytical results. The laboratory avoids performing matrix QC on known field blank samples, such as trip blanks and rinsates, since these samples are not indicative of the sample matrix.

Table 12. Matrix Control Samples

Control Sample Type	Details	
Matrix Duplicate (MD)	Use	Monitors the effect of site matrix on the precision of the method; and of the reproducibility of laboratory preparation and measurement techniques. **Note:** Precision may also be affected by the degree of homogeneity of the sample, particularly in the case of non-aqueous samples or aqueous samples with particulates. Sample homogeneity and matrix effect should be considered when field samples are used to assess reproducibility. **Note:** A field duplicate, when received, measures Representativeness of sampling and the effect of the site matrix upon precision.

Table 12. Matrix Control Samples

Control Sample Type	Details	
Matrix Duplicate (MD) (cont'd.)	Typical Frequency [1]	1 per 20 samples per matrix or per SAP/QAPP [2].
	Description	Performed by analyzing two aliquots of the same field sample independently; analyzed for each associated sample matrix (e.g., when requested by the client or the analytical method).
Matrix Spike (MS)	Use	Measures the effect of site sample matrix on the accuracy of the method.
	Typical Frequency [1]	1 per 20 samples per matrix or per SAP/QAPP.
	Description	Aliquot of a field sample which is spiked with the analytes or compounds of interest; analyzed for each associated sample matrix (when requested by the client or analytical method). The determination of MS percent recovery (% R) requires an analysis of a fortified sample and a non-fortified sample under the same procedural conditions (e.g., sample volumes, dilutions, procedural conditions, etc..). The concentration determined in the non-fortified sample is subtracted from the fortified sample concentration before determining the %R. The degree of homogeneity of the sample, particularly in the case on non-aqueous samples or samples with particulates, may affect the ability to obtain representative recoveries.
Matrix Spike Duplicate (MSD)	Use	Measures effect of site sample matrix on precision of method.
	Typical Frequency [1]	1 per 20 samples per matrix, when requested by the client or the analytical method, or per SAP/QAPP [2].
	Description	Alternative to sample duplicate. Generally, Inorganic protocols specify an MD/MS and organic protocols specify an MS/MSD.
Surrogate Spike	Use	Measures method performance to sample matrix (organics only).
	Typical Frequency [1]	Every QC and analytical sample.
	Description	Compounds similar to the target analytes in structure, composition and chromatography, but not typically found in the environment, are added to each QC and analytical sample, prior to preparation (e.g., extraction). If the surrogates in an analytical batch do not all conform to established control limits, the pattern of conformance in investigative and control samples is examined to determine the presence of matrix interference or the need for corrective action.
Internal Standards	Use	Monitor the qualitative aspect of organic and inorganic analytical measurements.
	Typical Frequency [1]	All organic and ICP methods as required by the analytical method.
	Description	Used to correct for matrix effects and to help troubleshoot variability in analytical response and are assessed after data acquisition. Possible sources of poor internal standard response are sample matrix, poor analytical technique or instrument performance.

[1] Denotes an STL required frequency.
[2] Either an MSD or an MD is required per 20 samples per matrix or per SAP/QAPP.

5.8.2.3 Matrix QC Frequencies

The frequency of matrix QC indicators depends on regulatory program compliance, a project's data quality objectives, or a client's requirements. The following frequency will be applied to samples when the regulatory programs are known and it does not conflict with project or client requirements.

Table 13. EPA Program Requirements

Program	Description [1]
SDWA	MD performed at a 10% frequency or 1 per preparation batch of ≤10 samples, whichever is more frequent.
CWA	MS (GC methods) and MD is performed at a 10% frequency or 1 per preparation batch of ≤10 samples, whichever is more frequent. For GC/MS Methods, MS is performed at a 5% frequency or 1 per preparation batch of ≤20 samples, whichever is more frequent.
RCRA	MS/MSD or MS/MD is performed at a rate of 5% per client (independent of the preparation batch). For clients submitting less than 10 samples, the method matrix QC requirement may be satisfied by another clients sample within the same prep batch unless the paperwork indicates a client requirement for matrix QC. Matrix QC will only be reported to the client who owns the data.
U.S. EPA CLP	MS/MSD or MS/MD is performed at a rate of 5% or 1 set per Sample Delivery Group (SDG) per matrix, independent of the prep batch. For NFESC samples, samples are processed in simultaneous or continuous batches.

[1] MS, MSD and MD may not be applicable to some analytical protocols because of the nature of the sample or protocol.

5.8.2.4 Method Performance Control Samples: Instrument Measurement

Control samples are used to ensure that optimum instrument performance is achieved. These samples help ensure that the proper identification and quantitation of target compounds or analytes are achieved. The instrument control samples appropriate to each analytical technique are described in laboratory SOPs for each respective method. A brief description of these checks is included in Table 14.

Table 14. Instrument Performance Control Samples

Control Sample Type	Description	
	Inorganics	
ICV	Use	Calibration standard of known concentration prepared from a source other than that used for the calibration standards.
	Sequence	Analyzed after the standard curve to confirm calibration.
ICB	Use	Blank water or solvent; confirms the calibration and assures that any potential contamination is less than the reporting limit.
	Sequence	Analyzed immediately after the ICV.

Table 14. Instrument Performance Control Samples

Control Sample Type		Description
ICP Interference Check Samples (ICSA/ICSB)	Use	Verifies the absence of spectral interferences.
	Sequence	Analyzed consecutively at the beginning of each eight hour analytical sequence, after the ICV/ICB, and again at an eight hour frequency following a CCV/CCB. When CLP protocols are followed, the ICSA/B will be analyzed with the analytical sequence, before the final CCV/CCB.
Reporting Limit Verification Standard (CRA and CRI)	Use	Verifies linearity near the reporting limit for CLP metals analyses. (Note: CRI is at a level 2X the CRDL; CRA is near the CRDL).
	Sequence	Analyzed after the ICB. The CRI is also analyzed at the end of the eight hour analytical sequence, prior to analysis of the final CCV/CCB.
CCV	Use	Confirm that the instrument performance has not significantly changed during the analytical sequence; to verify stable calibration throughout the sequence; and/or to demonstrate that instrument response did not drift over a period of non-use. Made from a source other than that used for the standard curve.
	Sequence	Analyzed at 10% or every two hours, whichever is more frequent; also analyzed at the end of the analytical sequence.
CCB	Use	Water blank used to confirm that the baseline has not drifted and to monitor for contamination at the reporting limit.
	Sequence	Analyzed at a rate of 10% for inorganics and at a rate of 1 per 10 readings/injections or every two hours, whichever is more frequent, for CLP metals; also analyzed at the end of the analytical sequence.
ICP Metals Linear Range	Use	Verify linearity and document the upper limit of the calibration range for each element.
Analysis Standard (LRS)	Sequence	Performed quarterly with a blank and a minimum of five standard concentrations to cover the anticipated range of measurement; one of the calibration standards will be at or near the reporting limit. The calibration curve generated must have a correlation coefficient $\geq$ 0.995 in order to consider the responses linear over that range.
ICP Inter-Element Correction (IEC)	Use	Correction factors for spectral interference (particularly due to Al, Ca, Fe, and Mg).
	Sequence	Determined at least annually for all wavelengths used for each analyte reported by ICP; or any time the ICP is adjusted in any way that may affect the IECs.
		Organics
GC/MS Tuning & Performance	Use	Ensures correct mass assignment and is monitored through response to target compounds during initial and continuing calibration, with minimum response criteria for specified system performance check compounds (SPCCs), and linearity is verified by evaluating the response factors (RF) for calibration check compounds (CCCs).

Table 14. Instrument Performance Control Samples

Control Sample Type	Description	
GC/MS Tuning & Performance (cont'd.)	Sequence	Tuned at the beginning of the daily work shift. Throughout the analysis, blanks, internal standard areas, surrogates, chromatographic baseline, resolution of peaks, and overall quality of the chromatography are used collectively to monitor instrument performance.
GC & HPLC Instrument Performance	Use	Monitored through retention time shift evaluation, linearity checks, and degradation checks of selected target compounds (e.g., for Endrin or DDT as appropriate).
	Sequence	Continuing calibration verification (e.g., blanks, shifts in chromatographic baseline or retention times, resolution of peaks, and overall quality of the chromatography) throughout the analytical sequence is accomplished through analysis of calibration check standards.

5.8.2.5 Method Performance Control Samples: Analysis Batch

Matrix specific control samples are used to assess the precision and accuracy of the method as applied to the specific sample matrix. These indicators provide information on sample matrix effects that is independent of the efficiency of the preparatory technique. The method performance control samples appropriate to each analytical technique are identified in the respective method. A brief description of these checks is included in Table 15.

These control samples are performed to provide a tool for evaluating how well the method performed for the respective matrix. These values are used by the client to assess the validity of a reported result within the context of the project's data quality objectives. For matrix specific QC results falling outside laboratory control limits which are attributed to matrix affects, no systematic corrective action is taken.

Table 15. Analysis Batch Performance Control Samples

Control Sample Type	Description	
ICP Serial Dilution	Use	5X Dilution of a field sample (performed at the instrument) to check for possible physical and/or chemical interferences.
	Sequence	5% of field samples or 1 per ≤20 samples per batch.
GFAA Analytical Bench Spike	Use	Required by the method; prepared at the instrument by fortifying the digestate with a known quantity of the analyte of interest.
	Sequence	Performed on each sample immediately following the unspiked original analysis.
Method of Standard Addition (MSA)	Use	When specified by the analytical protocol or by client request.
	Sequence	When specified by the analytical protocol or by client request.

5.8.3 Statistical Control Limits and Charts

Statistical control limits and control charts are used to establish method performance of a given analysis and to monitor trends of QC results graphically over time. Once a data base of the laboratory results for a method/matrix/QC analyte combination is established, the acceptability of a given analysis of that QC parameter (and of the analytical batch to which it belongs) can be evaluated in light of the laboratory's normal performance. This is intended to help identify problems before they might affect data. Often, patterns of response that are not at all evident in sets of numbers are very distinct when the same values are viewed as a chronological graph.

Establishment of Limits

The purpose of using statistical control limits is to define, for each analyte in a given method/matrix/QC type combination, a range of expected values. This range encompasses the random variation that occurs normally in the laboratory and allows one to evaluate control samples in that context, rather than according to an arbitrary or external set of values. Limits for accuracy and precision are defined below:

Accuracy

As recoveries of a QC analyte in a given matrix are tabulated over time, a mean value for recovery is established, as is the standard deviation (s) of those recoveries. If the analysis is in statistical control (e.g., if the set of QC recoveries over time show random variation about the mean) approximately 99.7% of all recoveries for that QC will fall within three standard deviations (3s) of the mean. Thus, assuming that the mean itself is an acceptable level of recovery, the values corresponding to 3s above and 3s below the mean are defined as the Control Limits. Any single recovery outside these values is assumed to have resulted from some circumstance other than normal variation and shall be investigated.

Roughly 95% of points should fall within 2s of the mean. The values +2s and -2s are the Warning Limits. Any normal result has approximately a 1/20 chance of being between 2s and 3s from the mean, so a result in this region doesn't necessarily warrant corrective action, but attention should be paid to such points.

Precision

Precision is used to indicate matrix variability so that appropriate decisions can be made by the client when repeated analyses vary significantly. The coefficient of variation, expressed as a percentage (e.g., the %RSD) for the data set used to calculate accuracy control limits defines the control limit for precision. Duplicate analyses of the QC samples, such as duplicates or MS/MSD, should have an RPD less than or equal to this established precision control limit to be considered free of matrix interferences.

The laboratory calculates statistical control limits on an annual basis. Such limits are available on a project or QAPP-specific basis.

5.8.4 Calibration

Calibration protocols are method-specific, are briefly described in Table 10 and are defined in the Sections 6 & 7 of the method SOPs.

5.8.5 Glassware Cleaning

All glassware is thoroughly cleaned prior to use to ensure that sample integrity is not affected from artifacts caused by contaminated glassware.

A summary of general cleaning procedures follows with details provided in the *Laboratory Glassware Cleaning* SOP (UQA-009):

General laboratory glassware is cleaned with a low- or non-phosphate detergent, followed by thorough rinsing with tap water and deionized water.
Volumetric flasks and pipettes used for inorganics (method dependent), test tubes and caps used for micro-COD procedures, phosphate glassware, and metals-related glassware include an acid-washing step.

BOD glassware cleaning includes a nitric or sulfuric acid and/or a NOCHROMIX-washing step.
Organic glassware includes a solvent-wash.
Non-volumetric organic glassware may optionally be kiln dried at 400°C.

5.8.6 Permitting Departures from Documented Procedure

Where a departure from a documented SOP, test method, or policy is determined to be necessary, or unavoidable, the departure is documented in a CAR or SDR and reported in the case narrative. In most cases, these departures can be made with the approval of the section manager, project manager and the client. Issues of serious concern, as determined by the Section Manager or Project Manager, will be brought to the attention of the Laboratory Manager and/or QA Manager. In some instances, it is appropriate to inform the client before permitting a departure. The Project Manager will make the determination as to the degree of notification required by the client.

On rare occasions, special analytical techniques will be requested for research, project specific requirements, or client needs. In these instances, SOPs may not be available, however, the analyst will thoroughly record the analytical steps and observations within a bound preformatted logbook.

5.8.7 Development of QC Criteria, Non-Specified in Method/Regulation

Where a method or regulation does not specify acceptance and/or rejection criteria, the laboratory must examine the data user's needs and the demonstrated sensitivity, accuracy and precision of the available test methods in determining appropriate QC criteria.

Data users often need the laboratory's best possible sensitivity, accuracy, and precision using a routinely offered test method, or are unsure of their objectives for the data. For routine test methods that are offered as part of STL's standard services, the laboratory bases the QC criteria on statistical information such as determination of sensitivity, historical accuracy and precision data, and method verification data. The method SOP includes QC criteria for ongoing demonstration that the established criteria are met (e.g., acceptable LCS accuracy ranges, precision requirements, method blank requirements, initial and continuing calibration criteria, etc..).

In some cases, a routine test method may be far more stringent than a specific data user's needs for a project. The laboratory may either use the routinely offered test method, or may opt to

develop an alternate test method based on the data user's objectives for sensitivity, accuracy, and precision. In this case, it can be appropriate to base the QC criteria on the data user's objectives, and demonstrate through method verification and ongoing QC samples that these objectives are met.

For example, a client may require that the laboratory to test for a single analyte with specific DQOs for sensitivity, accuracy, and precision as follows: Reporting Limit of 10 ppm, Accuracy ±25%, and RSD of <30%. The laboratory may opt to develop a method that meets these criteria and document through the Method Blank results, MDL study, and LCS results that the method satisfies those objectives. In this case, both the method and the embedded QC criteria have been based on the client's DQOs.

In some cases, the data user needs more stringent sensitivity, accuracy, and/or precision than the laboratory can provide using a routine test method. In this case, it is appropriate that the laboratory provide documentation of the sensitivity, accuracy, and precision obtainable to the data user and let the data user determine whether to use the best available method offered by the laboratory, or determine whether method development or further research is required.

5.9 Project Reports

The SOP for data package assembly and reporting formats is UDM-001 and a summary of this procedure follows.

Analytical reports comprise final results (uncorrected for blanks and recoveries unless specified), methods of analysis, levels of reporting, surrogate recovery data, and method blank data. In addition, special analytical problems will be noted in the case narratives. The number of significant figures reported are consistent with the limits of uncertainty inherent in the analytical method. Consequently, most analytical results will be reported to no more than two (2) or three (3) significant figures. Data are normally reported in units commonly used for the analyses performed.

Concentrations in liquids are expressed in terms of weight per unit volume (e.g., milligrams per liter, mg/L). Concentrations in solid or semi-solid matrices are expressed in terms of weight per unit weight of sample (e.g., micrograms per kilograms, ug/kg). Reporting limits take into account all appropriate concentration, dilution, and/or extraction factors, unless otherwise specified by program requirements (e.g., IRPMS reports).

A client report is generated with various steps of approval prior to printing of the final version. If any analytical anomalies were encountered during the analyses, e.g., an out-of-control matrix duplicate, it is documented in a case narrative. The case narrative is prepared by the respective operating unit and submitted to the data management section to insert in the final report.

The final report forms are printed, data packages are organized, a glossary of flags and acronyms is added, and reports are paginated.

5.9.1 General

The criteria described in Section 5.9.2 apply to all Project Reports that are generated under NELAC requirements. The criteria described in Section 5.9.3 and 5.9.4 apply to all Project Reports.

5.9.2 Project Report Content

- Title
- Laboratory name, address, telephone number, contact person
- Unique Laboratory Project Number
- Name and Address of Client
- Client Project Name (if applicable)
- Laboratory Sample Identification
- *Client Sample Identification*
- Matrix and/or Description of Sample
- Dates: Sample Receipt, Collection, Preparation and/or Analysis Date
- Definition of Data Qualifiers
- Reporting Units
- Test Methods
- Report Paginated

The following are required where applicable to the specific test method or matrix:

- Solid Samples: Indicate Dry or Wet Weight
- Whole Effluent Toxicity: Statistical package used
- If holding time $\leq$ 48 hours, Sample Collection, Preparation and/or Analysis Time
- Indication by flagging where results are reported below the quantitation limit.

5.9.3 Project Narrative

A Project Narrative and/or Cover Letter is included with each project report and, at a minimum, includes an explanation of any and all of the following occurrences:

- Non-conformances
- "Compromised" sample receipt (see Section 4.7.1)
- Method Deviations
- QC criteria failures

Project Release

The Project Manager or his designee authorizes the release of the project report with a signature.

Where amendments to project reports are required after issue, these are documented in the form of an RDR (refer to Section 4.8) and can be in the form of a separate document and/or electronic data deliverable resubmittal. The revised report is clearly identified as revised with the date of revision and the initials of the person making the revision. Specific pages of a project report may be revised using the above procedure with an accompanying cover letter indicating the page

numbers of the project revised. The original version of the project report will be kept intact and the revisions and cover letter included in the project files.

5.9.4 Subcontractor Test Results

Subcontracted data is clearly identified as such, and the name, address, and telephone number for the laboratory performing the test is included in the project report. Subcontracted results from laboratories external to STL are not reported on STL report forms or STL letterhead. Test results from more than one STL facility are clearly identified with the name of the STL facility that performed the testing, address, and telephone number for that facility. Data from subcontractors' reports may be added to an STL electronic deliverable.

Data subcontracted within STL may be reported on the originating laboratory's report forms provided the following mandatory requirements are met:

- The name, address, and telephone number of the facility are provided.
- Analytical results produced by the STL intra-company subcontractor are clearly identified as being produced by the subcontractor facility.
- The intra-company subcontractor's original report, including the chain of custody is retained by the originating laboratory.
- Proof of certification is retained by the originating laboratory.
- All information as outlined in Section 5.9.2 is included in the final report where the report is required to be compliant with NELAC, for both the originating and subcontracting laboratory.

5.9.5 Electronic Data Deliverables

Electronic Data Deliverables (EDD) are routinely offered as part of STL's services. STL offers a variety of EDD formats including Environmental Restoration Information Management System (ERPIMS), New Agency Standard (NAS), Format A, Excel, Dbase, GISKEY, and Text Files.

EDD specifications are submitted to the IT department by the Project Manager for review and undergo the contract review process in Section 4.4.1. Once the laboratory has committed to providing diskettes in a specific format, the coding of the format may need to be performed. This coding is documented and validated. The validation of the code is retained as a QC record. EDDs are subject to a secondary review to ensure their accuracy and completeness.

5.9.6 Project Report Format

STL offers a wide range of project reporting formats, including EDDs, short report formats, and complete data deliverable packages modeled on the Contract Laboratory Protocol (CLP) guidelines. More information on the range of project reports available in the Data Management SOP (UDM-001). Regardless of the level of reporting, all projects undergo the levels of review as described in Section 5.3.6.

Appendix. List of Cited SOPs and Work Instructions

Cited Section No(s).	Description	Document No.
1.6 5.7.1	Container Management: Process Operation	UCM-001
1.6 4.4.2	Project Management: Project Planning Process	UPM-003
4.1	Signature Authority	UQA-030
4.1.1	Work Instruction: Equipment & Instrumentation Listing	CHI-22-09-103
4.1.2.5	Sample Management: Subcontracting Processes	USM-001
4.1.2.9	Computer System Account and Naming Policy Password Policy Software Licensing Virus Protection Policy	P-I-003 P-I-004 P-I-005 P-I-006
4.12.2	Work Instruction: Records Management Form	CHI-22-05-032
4.3.1	Document Control	UQA-006
4.3.1.1 5.3.2	Approved SOP Listing	CHI-22-09-SOP List
4.3.2 4.12.3	Data Management: Record Retention & Purging	UDM-002
4.4.2	Project Kick-Off Meetings	UPM-002
4.6	Procurement Quality Assurance Process	UQA-020
4.6.1	Testing Solvents and Acids	S-T-001
4.7.2	Client Confidentiality	UQA-004
4.8 4.11	Sample Discrepancy Reports (SDRs) / Resubmitted Data Reports (RDRs) / Corrective Action Reports (CARs)	UQA-029
4.8 4.11	Quality Systems Management Review	UQA-002
4.11	Preventive Action Measures	UQA-019
4.13	Internal Audits	UQA-013
5.1.2	Training Program: Mechanisms and Documentation Processes Defined by Operational Assessment	UQA-014
5.3.1	Work Instruction: Methods Capabilities	CHI-22-09-255
5.3.2	SOP Change Protocol	UQA-032
5.3.5	Method Detection Limits (MDLs)	UQA-017
5.3.6.1	Acceptable Manual Integration Practices	S-Q-004
5.3.6.2	Data Review Checklists GC Extractables / HPLC GC Volatiles GC/MS: Volatiles and Semi-Volatiles Metals Wet Chemistry	 CHI-22-17-034 CHI-22-19-003 CHI-22-20-038 CHI-22-14-004; 5; 6 CHI-22-12-096
5.4.1	Work Instruction: Equipment Tracking Form	CHI-22-09-068
5.4.2	Instrument and Equipment Out-of-Service Tagging.	UQA-012
5.4.3	Selection of Calibration Points	P-T-001
5.5.1	Balance Calibration, Care and Use	UQA-003
5.5.1	Thermometer Calibrations	UQA-034
5.5.1	Water Quality	UQA-035

Appendix. List of Cited SOPs and Work Instructions

Cited Section No(s).	Description	Document No.
5.7.1	Sample Receipt: Handling and Processing	USR-001
5.7.5	Laboratory Waste Disposal Procedures	UWM-001
5.8.5	Glassware Cleaning Procedures	UQA-009
5.9 5.9.6	Data Management: Process Operation	UDM-001

APPENDIX C

HEALTH AND SAFETY PLAN

HEALTH AND SAFETY PLAN FOR

COLLINSVILLE, ILLINOIS PROPERTIES

Prepared by:

ADVANCED GEOSERVICES CORP.
West Chester, Pennsylvania

Project No. 2003-1055
May 18, 2004

TABLE OF CONTENTS

TABLE OF CONTENTS
(Continued)

LIST OF TABLES

TABLE

LIST OF FIGURES

FIGURE

TABLE OF CONTENTS
(Continued)

LIST OF ATTACHMENTS

ATTACHMENTS

1.0 INTRODUCTION

On behalf of NL Industries, Inc., Advanced GeoServices Corp. (AGC) developed this Health and Safety Plan (HASP) to reflect current health and safety procedures with regard to performing Removal Action (RA) activities at the former St. Louis Smelting and Refining Site (the Site) located in Madison County, Illinois as shown on Figure HASP-1 and Figure HASP-2. This HASP identifies procedures designed to reduce the risk of exposure to chemical substances that may be present and other potential physical, environmental, and biological hazards associated with RA activities at the Site.

This HASP provides the minimum health and safety requirements for contractors and subcontractors during the RA activities at the Site. The procedures set forth herein were developed in accordance with the provisions of 29 CFR 1910.120 (Hazardous Waste Operations and Emergency Response). Contractors and/or subcontractors performing RA activities may choose to use this HASP as a guide in developing their own plan (which shall be reviewed and approved by NL Industries, Inc.), or may choose to adopt and comply in full with this HASP when performing RA activities at the Site. At a minimum, all provisions of this HASP will be followed. If the contractor and/or subcontractor adopts this HASP, all personnel assigned to field activities for the project must read and sign the HASP Acknowledgment Form (Attachment 1) before commencing site activities. AGC reserves the right to review and revise this HASP at any time.

AGC notes that other ancillary personnel conducting work not related to the RA activities at the Site are not bound by the procedures presented in this HASP. AGC does not accept any liability or responsibility for the actions of NL Industries, Inc. employees, contractors or subcontractors and other ancillary personnel conducting activities at the Site.

1.1 NATURE OF CONTAMINATION

The primary constituent of concern at the Site is lead in soil. The investigations conducted at the Site during the 1980's and 1990's indicate that residential soils contain total lead concentrations from below detection levels to over 1,200 parts per million (ppm).

1.2 POTENTIAL REMEDIAL ACTION (RA) ACTIVITIES

The potential RA activities anticipated at this time are summarized as follows:

- Site walks;
- Soil sampling for waste characterization and lateral limit delineation;
- Site boundary/utility survey.
- General removal action construction activities (construction trailers, soil staging area, etc.);
- Excavation of surface soils with total lead concentrations greater than the applicable clean-up level;
- Characterization and off-site disposal of excavated soils;
- Confirmatory soil sampling;
- Backfill and restoration of properties; and
- Demobilization.

1.3 KEY REGULATIONS

Key regulations that are or may be applicable to the proposed RA field activities are listed below. Field activities and operations associated with this project (if applicable) will be conducted in general accordance with these regulations.

Government Regulations	Subject
29 CFR 1904	Recording and Reporting Occupational Injuries and Illness
29 CFR 1910.120	Hazardous Waste Site Operations
29 CFR 1910.20	Record Keeping/Recording
29 CFR 1910.1000	OSHA Permissible Exposure Limits
29 CFR 1926.62	Lead in Construction
29 CFR 1926.650 - .652	Excavations
29 CFR 1910.134	Respirator Protection

1.4 HASP ORGANIZATION

The remainder of this HASP, which describes project activities, is formatted into the following sections:

- Section 2.0 - Key Personnel and Management
- Section 3.0 - Site Access and Control
- Section 4.0 - Training
- Section 5.0 - Medical Monitoring
- Section 6.0 - Project Hazard Analysis
- Section 7.0 -Personal Protective Equipment
- Section 8.0 –Decontamination

2.0 KEY PERSONNEL AND MANAGEMENT

This section identifies the key personnel of the Contractor under this HASP.

2.1 PROJECT COORDINATOR

The Project Coordinator (PC) shall be responsible for the overall successful and safe completion of all RA field activities. The PC shall be responsible for the following tasks as related to health and safety:

- Confirming the Project Manager and the Site Health and Safety Officer (HSO) are performing field tasks in a safe manner.

- Ensuring that all Site personnel have been properly trained in accordance with OSHA 1910.120 and are familiar with the applicable provision of 1926.62 and 1926.650 - 652.

- Maintaining communication with client representatives and representatives of regulatory agencies.

2.2 PROJECT MANAGER

The Project Manager (PM) shall be directly responsible for the completion of all RA related field activities. The PM will assist the PC with all tasks described above. The PM has responsibility for all field activities and shall enforce safe work practices by all individuals present on the project site. The HSO and the PM may be the same individual. The PM will be an employee and the contractor.

2.3 SITE HEALTH AND SAFETY OFFICER (HSO)

The PM will designate a HSO for this project to implement and enforce the Site health and safety program described in this HASP. During field activities, the HSO will conduct daily safety meetings and will interface as required with other Site representatives. The HSO shall be responsible for the following tasks:

- Performing routine RA Site activity inspections to document that all work is being performed safely.
- Ordering the immediate shut-down of RA Site activities in the case of a medical emergency or unsafe work practice.
- Confirming protective clothing and equipment are used, maintained, and stored properly.
- Maintaining exclusion zones.
- Conducting daily safety meetings.
- Contacting the appropriate authorities in the event of an emergency (injury/accident).
- Designating an area and providing employee accounting in case of site evacuation.
- Conducting or overseeing required monitoring activities.
- The HSO will function as the competent person in accordance with the OSHA Lead in Construction and Excavation Standards.

The HSO will maintain a daily safety log detailing all relevant daily RA activities in a bound field book. This log will include daily safety meeting topics, training administered, air monitoring information, the names of site personnel and visitors, accidents and injuries, and any other incidents pertaining to health and safety. The HSO shall confirm that all employees on-site are participants in a medical surveillance program compliant with OSHA 1910.120 and 1926.62, as applicable.

2.4 EQUIPMENT OPERATORS

Equipment operators will be appropriately trained in the safe operation of their equipment, and responsible for the maintenance, and daily inspection of their equipment.

2.5 EMPLOYEE SAFETY RESPONSIBILITY

Each employee is responsible for their own safety as well as the safety of others in the area. The employee shall use all equipment provided in a safe and responsible manner as directed by their supervisor. All personnel involved with this project will follow the health and safety procedures set forth in this HASP. Visitors will not be permitted entry to RA activity areas until they have read this HASP and signed the Acknowledgment Form provided in Attachment 1, and only as approved by the PC or PM.

2.6 EMERGENCY CONTACTS

Table HASP-1 lists the emergency contacts and corresponding telephone numbers for the project and the Site. The emergency route to the closest hospital is shown on Figure HASP-3.

3.0 TRAINING

3.1 PERSONNEL TRAINING

Site workers (such as equipment operators, general laborers, and supervisory personnel) engaged in hazardous substance activities or other RA field activities which expose or potentially expose workers to hazardous substances and health hazards shall receive a minimum of 40 hours of health and safety training (29 CFR 1910.120) off the Site. Supervisors shall have received an additional 8 hours of specialized supervisory training. Additionally, 8 hours of refresher training is required annually for all site personnel. The Project Manager may provide exemptions to this requirement (e.g., decreasing the number of training hours to 24 is possible for workers, like surveyors, who are doing non-intrusive work or workers conducting activities entirely in the support zone). An exemption may be provided by the Project Manager for visitors to the Site who will not be performing intrusive activities and will be accompanied by trained personnel at all times. A more detailed discussion of training requirements is included in Attachment 2. Documentation of personnel meeting the required training will be maintained by the Project Manager.

This HASP will be distributed to all project personnel prior to the start of field activities. A pre-operation meeting for each task will be held to discuss the contents of the HASP. Specialty training will be provided on an as necessary basis based on task and responsibility. All training of personnel will be conducted under direct supervision of a trained HSO or his/her designee.

3.2 SITE-SPECIFIC TRAINING TOPICS

All personnel entering the Site will be trained, as applicable, on the following site-specific topics:

- Site hazards;
- Emergency procedures;
- Insect and animal hazards;
- Lead in Construction Standard, 29 CFR 1926.62

- Excavation Standard, 29 CFR 1926.650 - .652;
- Personal protective equipment (PPE);
- Safe work practices; and
- Decontamination procedures.

4.0 AIR MONITORING

Air monitoring will be performed to monitor dust particles due to soil disturbance operations. Ambient air monitors will be installed upwind and downwind of active operations and at the primary entranceway into the residences for residential work areas. Real time aerosol monitors (mini-Rams or similar) will be co-located and operated during active operations. The Air Monitoring Plan (Attachment 3) details the air monitoring action levels and procedures.

5.0 SITE CONTINGENCY

As required by the Administrative Order on Consent for removal action, a Site Contingency Plan has been developed and is included as Attachment 4.

6.0 MEDICAL MONITORING

Personnel conducting RA field activities associated with this project shall be active participants in a medical monitoring program that complies with the requirements of 29 CFR 1910.120. Documentation of the medical monitoring program for each individual shall be maintained at the individual employer's office.

Contractors and subcontractors will be required to adhere to the applicable medical monitoring requirement of CFR 1910.120 and provide documentation of compliance. Exemptions to this requirement may be granted in specific situations where this monitoring is determined to be unnecessary by the Project Manager or HSO. An example of such an exemption would be a delivery driver who makes a delivery to the Site in an area which has been characterized as having no contamination or no significant potential for exposure to constituents. General information on medical monitoring is provided in Attachment 5.

Medical monitoring in accordance with 29 CFR 1926.62 will also be required.

7.0 PROJECT HAZARD ANALYSIS

This section discusses chemical, physical, and environmental hazards with respect to performing RA field activities at the Site.

7.1 CHEMICAL HAZARDS

Table HASP-2 identifies the exposure limits and recognition qualities for lead at the Site in terms of human health impacts. Table HASP-3 summarizes health hazards and symptoms associated with lead.

To provide appropriate protection, employees shall wear appropriate PPE, as detailed in Section 8.0, when undertaking site RA activities. Levels of PPE for employees working on this project will be selected and utilized based on the direct reading of monitoring instruments (as necessary), physical/health hazards and on-site assessment by the PM or HSO.

7.1.1 General Precautions

If signs of contamination are encountered that differ from those addressed in this plan, such as visible soil stains or unusual odors, contractor(s) will stop all work in the area, barricade or otherwise isolate the area, and immediately contact the Project Manager or the Health and Safety Officer. Protection of worker health and safety shall be the first priority. Continuation of work in the area and the amount of, if any, personal protective equipment shall be determined by the Health and Safety Officer. Other precautions to be undertaken to ensure a safe work place on this project where the potential for chemical exposure may exist include:

- No smoking, eating, or drinking in areas where contaminants may be present.
- Avoid the area immediately downwind of any excavation.

- Contact with potential contaminated materials should be minimized through the knowledge of site conditions and the location of potential contamination based on previous site investigation reports.

- Minimize the creation of dust, through dust suppression such as water application.

- Adequately barricade all work zones to ensure public safety.

7.2 PHYSICAL HAZARDS

In addition to the potential chemical hazards, physical hazards may be encountered when conducting specific activities on-site and are described in Table HASP-4. In order to minimize physical hazards, standard safety procedures which are also described in this table will be followed at all times. Failure to comply with safety procedures or continued negligence of these policies will result in expulsion of an employee from the project site. The work practices of all employees will be carefully monitored by the HSO to confirm that all work is performed in a safe and professional manner.

7.3 ENVIRONMENTAL HAZARDS

Identification of environmental hazards and procedures to monitor and reduce these hazards are listed in Table HASP-4.

7.4 BIOLOGICAL HAZARDS

Identification of biological hazards and procedures to monitor and reduce these hazards are listed in Table HASP-4.

7.5 RADIOLOGICAL HAZARDS (XRF)

The XRF portable analyzer contains radiation sources that require specific handling procedures. For this reason, use of the portable analyzer will be limited to those personnel who have been trained in its use. A standard operating procedure is included with the equipment. A Radiation Safety Officer located in the AGC West Chester office is available to assist with questions.

7.6 SPECIAL HAZARDS/CONSIDERATIONS

During the excavation, treatment, or back fill operations, trenching and/or shoring may become necessary. It is not anticipated that these types of operations will be required; however Attachment 6 describes precautions to be used in the event of said operations.

8.0 PERSONAL PROTECTIVE EQUIPMENT

This section identifies the required PPE to be used on this project and may be modified, as appropriate, by the HSO. The initiation and anticipated PPE requirements for all RA field activities conducted on-site is Level "D" PPE. Upgrades to PPE monitoring will be based on air monitoring readings as discussed below.

8.1 LEVEL D PPE

It is anticipated that all activities on-site will be conducted in Level D PPE. Personnel conducting site activities in Level D will wear the following:

1. Cotton coveralls or Tyvek coveralls
2. Boots, steel toe and shank (may use plastic or rubber booty cover)
3. Safety glasses with side shields or goggles (ANSI approved) (as necessary per HSO)
4. Hard hat (ANSI approved) (as necessary per HSO)
5. Ear plugs will be worn when working near heavy equipment
6. Nitrile gloves will be worn when the potential for direct contact is made with soils
7. Personal flotation device (when working on or near open water bodies)

8.2 LEVEL C PPE

AGC does not anticipate the need to upgrade from Level D on this project. This type of upgrade would only be done after consulting with the USEPA Project Manager.

Level D PPE will be upgraded to Level C if air sampling indicates the following in the breathing zone:

- Respirable particulate matter concentrations measured with the aerosol monitor are greater than 5.0 milligrams per cubic meter (mg/m^3) and less than 10.0 mg/m^3.

- Personal air monitoring analytical laboratory results indicate lead concentrations greater than 0.025 mg/m^3 and less than 0.25 mg/m^3.

Personnel conducting Site activities in Level C will wear the following:

1. Full-face air purifying respirators equipped with combination HEPA/organic vapor filter cartridges (NIOSH approved).
2. Chemical-resistant clothing (disposable chemical-resistant coveralls).
3. Gloves, nitrile.
4. Boots, steel toe and shank.
5. Boot-covers, outer, chemical-resistant (disposable or washable).
6. Hard hat (ANSI approved).
7. Ear plugs will be worn when working near heavy equipment.
8. Personal flotation device (when working on or near open water bodies)

8.3 LEVEL B PPE

AGC does not anticipate the need to upgrade from Level D on this project. This type of upgrade would only be done after consulting with the USEPA Project Manager.

PPE levels will be upgraded from Level C to Level B if the following are measured in the breathing zone:

- Respirable particulate matter is 10.0 mg/m^3 or greater.
- Personal air monitoring lead concentrations greater than 0.25 mg/m^3.

As described below, Level B PPE includes a positive pressure, full face piece SCBA.

Personnel conducting Site activities will wear the following Level B protection.

1. Positive pressure, full-face piece self-contained breathing apparatus (SCBA), or positive pressure supplied air respirator with escape SCBA (NIOSH approved).
2. Hooded chemical-resistant clothing (disposable chemical-resistant coveralls).
3. Gloves, outer, nitrile (neoprene for personnel handling drums).
4. Gloves, inner, latex.
5. Boots, steel toe and shank.
6. Boot-covers, outer, chemical-resistant (disposable).
7. Hard hat (ANSI approved).
8. Ear plugs will be worn when working near heavy equipment.
9. Five minute escape pack.
10. Personal flotation device (when working on or near open water bodies)

8.4 MODIFICATIONS TO PPE LEVEL

Levels of protection utilized for all tasks shall be adjusted and/or confirmed as significant new information becomes available. Any changes or adjustments will be amended in this HASP.

8.5 RESPIRATORY PROTECTION

All respiratory protection equipment and cartridges used on this project shall be NIOSH/MSHA approved or equivalent. Workers required to wear respiratory protection shall be trained in the use, maintenance and limitations of their assigned respirators. This review will include the information described below.

8.5.1 Supplied-Air Respirators

If it is necessary to upgrade to level B, workers shall be issued either a self-contained breathing apparatus (SCBA) or an air line respirator. In addition, workers shall be equipped with a 5-minute escape bottle.

8.5.2 Breathing-Air Quality

Code of Federal Regulations 29 CFR 1910.134 states breathing air shall meet the requirements of the specification for Grade "D" breathing air as described in the compressed Gas Association Specification G 7-1966. AGC will require a certificate of analysis from vendors of breathing air in order to show that the air meets this standard.

All compressed air cylinders must be tested in accordance with the US Department of Transportation (USDOT) (49 CFR 178) and labeled to identify their contents in accordance with ANSI standard Z48.1, Federal Specifications BB-A-103a, or Interim Federal Specification GG-B-00675b.

Airline couplings must be incompatible with other gas systems to prevent accidental introduction of non-respirable gases.

The preferred method for creating breathing air shall be to mix liquid oxygen and liquid nitrogen. Air compressors located at project sites are not acceptable because of possible contamination at the intake of the pump and excessive analytical costs of sampling the air.

8.5.3 Air-Purifying Respirators

All air purifying respirators used by personnel working at the Site shall meet NIOSH/MSHA approval. Air purifying respirators used on this project shall include full-face, negative pressure, and full-face, powered air purifying respirators.

8.5.4 Filter Cartridge Changes

All filter cartridges will be changed a minimum of once daily. Changes will occur when personnel begin to experience increased inhalation resistance, or breakthrough of a chemical warning property.

8.5.5 Inspection and Cleaning

Respirators shall be checked periodically by a qualified individual and inspected before each use by the wearer. All respirators and associated equipment will be decontaminated and hygienically cleaned after use. It is the responsibility of the wearer to clean and maintain his/her respirator.

8.5.6 Fit Testing

Qualitative fit testing will be performed annually for all employees required to wear a negative pressure respirator.

8.5.7 Facial Hair

No personnel with facial hair which may interfere with the respirator's sealing surface will be permitted to wear a respirator.

8.5.8 Medical Certification

Only workers who have been medically cleared by a physician as being physically capable of wearing a respirator will be issued a respirator. Documentation of the medical clearance for respirator work shall be retained at the Site.

9.0 DECONTAMINATION

This section describes the personnel and equipment decontamination procedures to be used for the various tasks to be performed on-site. Decontamination associated with sampling equipment is provided in the Quality Assurance Project Plan (QAPP).

9.1 PERSONNEL DECONTAMINATION: LEVEL B, C AND D WORK

The general guide for the decontamination sequence of each level of protection to be used on-site is presented below. Workers assisting in decontamination procedures shall don a level of protection that is one grade below that of field personnel utilizing the Contaminant Reduction Zone (CRZ).

Level B	Level C	Level D
Step 1 Wash outer boots	Wash outer boots	Remove coveralls/Tyvek®
Step 2 Remove outer gloves	Remove outer gloves	Wash boots
Step 3 Wash inner gloves	Remove coveralls	Remove nitrile gloves
Step 4 Remove coveralls	Remove outer boots	Wash hands/face
Step 5 Remove boots	Remove respirator	
Step 6 Remove respirator	Remove inner gloves	
Step 7 Remove inner gloves	Wash hands/face	
Step 8 Wash hands/face	Clean respirator	
Step 9 Clean Respirator		

9.2 TOOLS AND EQUIPMENT

Tools and hand equipment, as necessary, should be decontaminated prior to removal from the exclusion zone. Decontamination procedures shall include washing with a low pressure sprayer and a mild detergent such as Alconox. Tools and hand equipment that cannot be decontaminated properly should be discarded.

9.3 RESPIRATORS AND PPE

Employees shall be responsible for cleaning and maintaining their respirators. A clean area shall be established to clean and store respirators. Respirators should be cleaned with mild soap and warm water.

Reusable PPE will be stored at the CRZ in drums or plastic bags and will be decontaminated at the end of each shift by a designated individual at the CRZ using water and Alconox.

9.4 HEAVY EQUIPMENT

Heavy equipment such as drill rigs, trucks, bulldozers and backhoes that are used inside the exclusion zone shall be decontaminated. Decontamination of heavy equipment will be conducted using hand tools and dry decontamination techniques. If this is not adequate to remove the accumulated soil debris, a pressure washer using non-phosphate detergent will be used. Prior to using the pressure washer, gross contamination (i.e., soil in wheels or tracks) will be minimized by removal with hand tools (e.g., shovels, stiff-bristle brushes). The HSO will determine the need for additional decontamination in excess of hand tools and dry decontamination techniques.

TABLES

Table HASP-1
Emergency Phone Numbers

ORGANIZATION	TELEPHONE
Ambulance	911
Police	911
Fire	911
Hospital: Anderson Hospital	(618) 228-5711
HazMat Response Team	911
Chris Reitman, Project Director, AGC Barbara Forslund, Alternate Project Director, AGC	(610)-840-9100 (work) - (610)-701-0670 (home) (610)-840-9100
USEPA On-Scene Coordinator - Kevin Turner	(618)-997-0115
USEPA Region 5 Hotline	(312)-353-2000
Project Officer, IEPA, Gerald E. Willman	(217)-524-6365
IEPA Emergency Response (24-hour)	(800)-782-7860 (217)-782-7860
Representing NL Industries, Terry Casey	(281)-351-9441

Table HASP-2
Exposure Limits and Recognition Qualities

	EXPOSURE STANDARDS				RECOGNITION QUALITIES		
COMPOUND	PEL (mg/m^3)	TLV mg/m^3	STEL (c) mg/m^3	IDLH (a) mg/m^3	Odor/(d) Threshold	LEL (b) (%)	Ionization Potential (eV)
Lead	0.05	0.05	--	100	Odorless	--	--

Notes:

(a) Immediately Dangerous to Life and Health.
(b) Lower Explosive Limit.
(c) OSHA Short Term Exposure Limit - 15 minute exposure.
(d) Sense of smell becomes rapidly fatigued and cannot be relied upon to warn of the continuous presence of contaminants.

Table HASP-3
Health Hazards and Symptoms

COMPOUND	ROUTES OF ENTRY	EYE IRRITATION	SYMPTOMS	TARGET ORGANS
Lead	Inhalation, ingestion, skin, and/or eye contact	Yes	Weakness, insomnia, weight loss, malaise, constipation, abdominal pain, colic, anemia, kidney disease, eye irritation and hypertension	Eyes, gastrointestinal tract, central nervous system, kidneys, blood, gingival tissue and peripheral nervous system

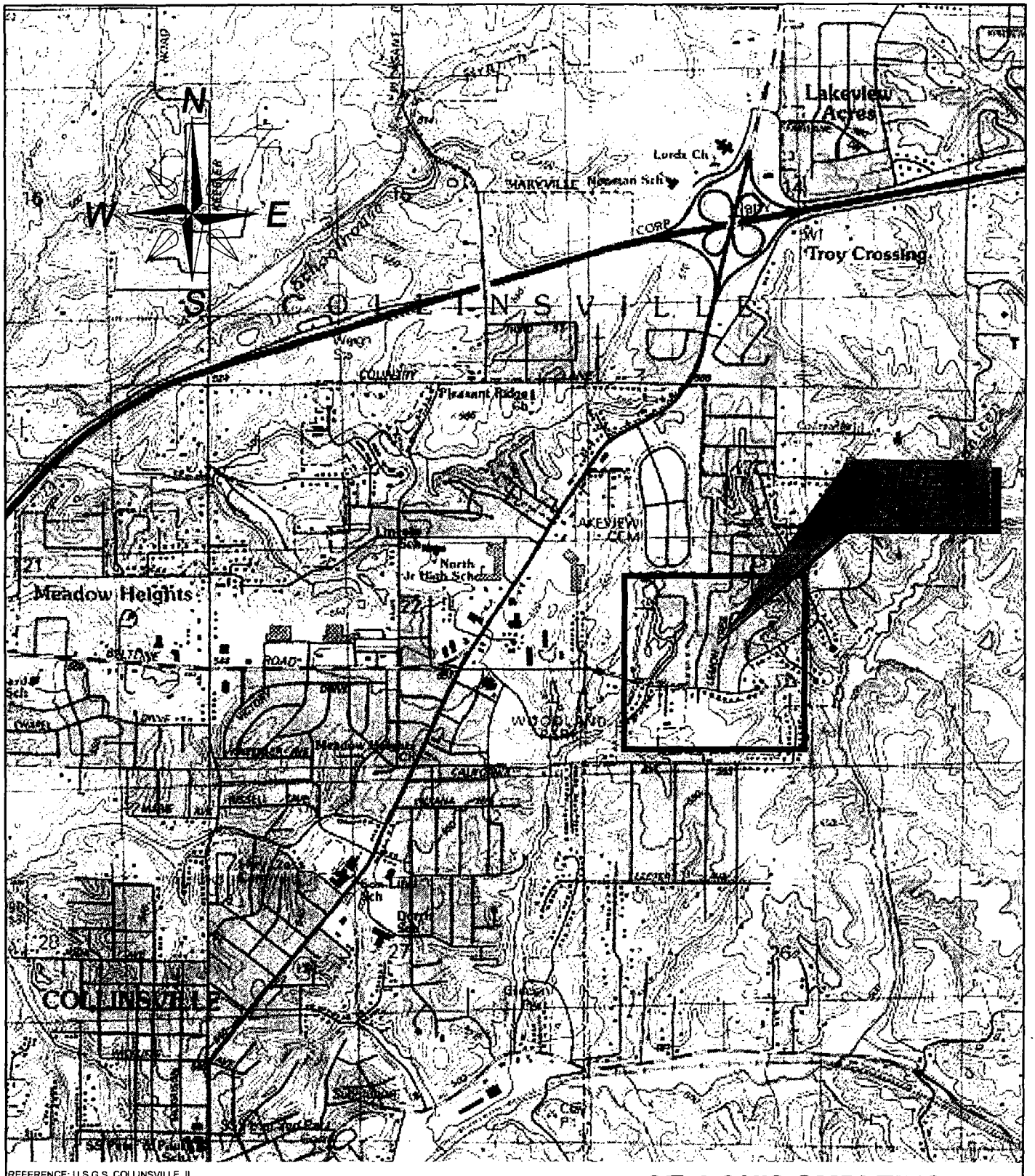
GENERAL FIRST AID TREATMENT

- Eye: Irrigate immediately
- Skin: Soap wash promptly
- Inhalation: Move to fresh air
- Ingestion: Get medical attention

Table HASP-4
Activity Hazard Analysis

HAZARD	DESCRIPTION	LOCATION	PROCEDURE USED TO MONITOR/REDUCE HAZARD
Heavy equipment	Front end loader, backhoes, and trucks	Throughout the Site	Personnel maintain eye contact with operators: hard hats, safety shoes, and eye and ear protection worn (as appropriate) during equipment operation
Refuse and soil	Construction material	Throughout the Site	Maintain clean work areas, dispose of refuse immediately; do not block access routes with materials. No one will enter excavations. Temporary fences will be placed around any excavations left open overnight
Heat producing/electrical equipment	Generators, vehicles, steam cleaners, power tools	Throughout the Site	Operate equipment away from vegetation and other materials that may ignite. Maintain fire-fighting equipment in the vicinity of operating equipment
Heat stress/cold exposure	Personnel working under temperature extremes are subject to adverse effects	Throughout the Site	Employ buddy system. Each worker is responsible for visually monitoring his/her partner for signs for heat stress or cold exposure. Site safety personnel will also monitor site conditions and establish work/rest regimes.
Chemical exposure	Personnel may be exposed to lead dust associated with the Site. Also chemicals from equipment decontamination.	Throughout the Site	Follow guidelines in HASP. Be familiar with signs and symptoms of exposure and first aid procedures. Report suspected over-exposure to Site Safety Officer immediately
Biological hazards	Snakebites, bee stings, tick bites, poisonous plants	Throughout the Site	Be familiar with signs and symptoms of exposure and first aid procedures. Report suspected exposure to Site Safety Officer immediately
Slips, trips, and falls	Miscellaneous debris	Throughout the Site	Use caution when traversing site and be aware of trip hazards
Drowning	Falling into open water bodies	Near open water bodies	Use caution when taking sediment samples. Utilize buddy system during sampling. Wear life preservers if drowning is a risk.
Using XRF	Working with or near XRF	Near XRF	Follow safety guidelines in manufacturer's user's guide. Open shutter on XRF only when performing a test.

FIGURES



REFERENCE: U.S.G.S. COLLINSVILLE, IL
7.5 MINUTE QUADRANGLE MAP 1991.

ST. LOUIS SMELTING AND REFINING SITE

COLLINSVILLE, ILLINOIS

2000 0 2000 4000

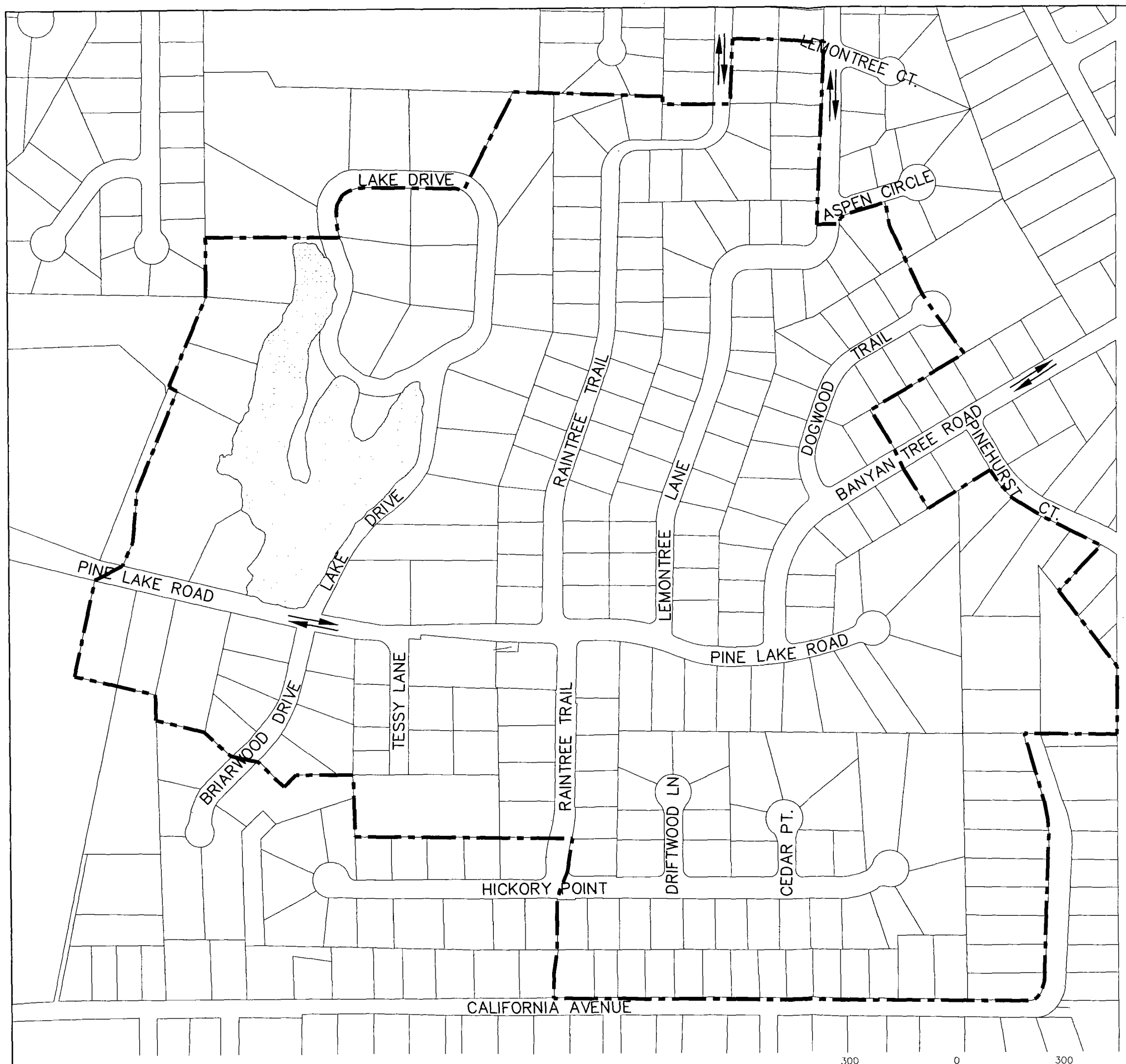
SCALE IN FEET

J:\Collinsville Smelter\drawings\2003-1055-01\2003-1055-01-10

Scale: 1" = 2000'	SITE LOCATION MAP
Originated By: K.O.	
Drawn By:	
Checked By:	
Project Mgr: C.T.R.	
Dwg. No. 2003-1055-01-10	
MAY 18 2004	Project No. 2003-1055-01

Advanced GeoServices Corp.
1055 Andrew Drive, Suite A
West Chester, Pennsylvania 19380
(610) 840-9100
FAX: (610) 840-9199

FIGURE: HASP-1



N
W E
S

LEGEND:

- LIMIT OF AREA UNDER CONSIDERATION FOR SOIL REMOVAL.EXCLUSION ZONES WITHIN THIS AREA WILL VARY DEPENDING UPON AREA OF CURRENT OPERATIONS AND RESULTS OF SOIL SAMPLING. (SEE NOTE 1)
- PINE LAKE
- POTENTIAL TRAFFIC ROUTES

NOTES:

1. SOIL REMOVAL AREA LINE BASED ON IEPA SOIL SAMPLING: ADDITIONAL SAMPLING WILL BE PERFORMED TO CONFIRM / ADJUST LINE.
2. SUBDIVSION DRAWING PROVIDED IN NAD 83 ILLINOIS WEST BY MADISON COUNTY MAPS AND PLATS GIS DIVISION.

ST. LOUIS SMELTING AND REFINING SITE

COLLINSVILLE, ILLINOIS

Scale: 1" = 300'	SITE PLAN
Originated By: K.O.	
Drawn By: K.O.	
Checked By: C.T.R.	
Project Mgr: C.T.R.	
Dwg No. 2003-1055-01-11	
Issued: MAY 18 2004	Project No. 2003-105501 — FIGURE: HASP-2

Advanced GeoServices Corp.
1055 Andrew Drive Suite A
West Chester, Pennsylvania 19380
(610) 840-9100
FAX: (610) 840-9199

J:\Collinsville/drawings/2003-1055-01/2002-1055-01-11

DIRECTIONS:

EXIT SITE ONTO PINE LAKE ROAD TRAVELING WEST
TURN RIGHT ONTO VANDALIA ST. (IL-159)
TURN RIGHT ONTO CHEROKEE AVENUE (IL-162) AND
TURN RIGHT INTO HOSPITAL.

ST. LOUIS SMELTING AND REFINING SITE

COLLINSVILLE, ILLINOIS

Scale: N.T.S.	EMERGENCY ROUTE TO HOSPITAL
Originated By: S.V.G.G.	
Drawn By: S.M.F.	
Checked By: S.V.G.G.	
Project Mgr: C.T.R.	
Dwg No. 2003-1055-01-07	
Issued:	Project No. 2003-1055-01 — FIGURE: HASP-3

Advanced GeoServices Corp.
1055 Andrew Drive, Suite A
West Chester, Pennsylvania 19380
(610) 840-9100
FAX: (610) 840-9199

J:\Collinsville Smelter\drawings\2003-1055-01\2003-1055-01-07

MAY 18 2004

ATTACHMENTS

ATTACHMENT 1 TO HASP

ACKNOWLEDGMENT

ATTACHMENT 1
Acknowledgment

St. Louis Smelting and Refining Site
Collinsville, Illinois

I have read, understand and agree with the information set forth in this Health and Safety Plan and will adhere to the protocols specified herein. I have been trained in accordance with OSHA 1910.120 and participate in a medical monitoring program.

Field Manager	Signature	Date
Site Health and Safety Officer	Signature	Date
Site Worker	Signature	Date
Site Worker	Signature	Date
Site Worker	Signature	Date
Site Worker	Signature	Date
Site Worker	Signature	Date
Site Worker	Signature	Date
Site Worker	Signature	Date

SUBCONTRACTORS/VISITORS:

Name	Signature	Date
Name	Signature	Date
Name	Signature	Date
Name	Signature	Date

ATTACHMENT 2 TO HASP

PERSONNEL TRAINING

ATTACHMENT 2
Personnel Training

General site workers (such as equipment operators, general laborers and supervisory personnel) engaged in hazardous substance activities or other activities which expose or potentially expose workers to hazardous substances and health hazards shall receive a minimum of 40 hours of classroom instruction. The training course must have included the following material at a minimum:

1. Health and Safety Officer and Site Management Responsibilities - personnel must understand Health and Safety Officer and Site Management responsibilities and authority.

2. Site-Specific Health and Safety Hazards - personnel must be informed of specific hazards related to site and site operations.

3. Personal Protection Equipment (PPE) - personnel must be trained in proper use of personal protective equipment.

4. Safe Work Practices/Engineering Controls - personnel must be informed of appropriate work practices and engineering controls that will reduce the risk of exposure to site hazards.

5. Safety Equipment Use - personnel must understand the use of monitoring instruments and other safety equipment.

6. Medical Surveillance Program - personnel must be informed of requirements for medical surveillance of hazardous waste site employees.

7. Site Control Methods - personnel must understand site methods used to reduce exposure to on-site personnel.

8. Decontamination Procedures - personnel must be trained in proper decontamination operation and procedures.

9. Emergency Response - personnel must be trained in proper emergency response operation and procedures.

10. Confined Space Entry/Special Hazards - personnel involved in specific hazardous activities, such as confined space entry and drum handling, must receive training in appropriate techniques to employ during such operations.

Workers on-site only occasionally for a specific limited task (such as, but not limited to, land surveying or site walk through) and who are unlikely to be exposed over permissible exposure limits and published exposure limits shall receive a minimum of 24 hours of classroom instruction and the minimum of one day actual field experience under the direct supervision of a trained, experienced supervisor.

Workers regularly on-site who work in areas which have been monitored and fully characterized indicating that exposures are under permissible exposure limits, where respirators are not necessary, and the characterization indicates that there are no health hazards or the possibility of an emergency developing, shall receive a minimum of 24 hours of instruction off the site and the minimum of one day actual field experience under the direct supervision of a trained, experienced supervisor.

Workers with 24 hours of training who meet the criteria for 24 hour training cited above, and who become general site workers or who are required to wear respirators, shall have the additional 16 hours and two days of training necessary to total the training specified for the 40 hour training criteria.

Health and Safety training programs shall comply with criteria set forth by OSHA as per final regulation 29 CFR 1910.120. This program will instruct employees on general health and safety principles and procedures, proper operation of monitoring instruments, and use of personal protective equipment.

In addition, field employees will undergo site-specific training prior to the start-up of any given task. As activities change at a particular site, related training will address potential hazards and associated risks, site operating procedures, emergency response, and site control methods to be employed.

Specialized training will be provided as dictated by the nature of the project activities. Specialized training will be provided for activities such as confined space entry, excavations and handling of unidentified substances.

This Health and Safety Plan must be distributed to all contractor/subcontractors prior to the start of field activities. A pre-operation meeting will be held to discuss the contents of the Plan. Specialty training will be provided as determined by task and responsibility. All training of project personnel will be conducted under direct supervision of the HSO or their designee. Exemption from training may be approved by the HSO in conjunction with the Project Manager.

ATTACHMENT 3 TO HASP

AIR MONITORING PLAN

ATTACHMENT 3 TO HASP

AIR MONITORING PLAN FOR

COLLINSVILLE, ILLINOIS PROPERTIES

Prepared By:

ADVANCED GEOSERVICES CORP.
West Chester, Pennsylvania

2003-1055-01
May 18, 2004

TABLE OF CONTENTS

PAGE NO.

LIST OF TABLES

TABLES

1.0 INTRODUCTION

This Air Monitoring Plan (the AMP) was prepared by Advanced Geoservices Corp. (AGC) on behalf of NL Industries, Inc. for the St. Louis Smelting and Refining Site (Site) in Collinsville, Madison County, Illinois. This Plan is Attachment 3 of the Health and Safety Plan.

The purpose of the AMP is to provide the reader with a description of the proposed air monitoring program to be conducted to monitor dust emissions during implementation of remedial action (RA) activities at the Site. Specifically, sampling, excavation, stockpiling, transportation, soil treatment and backfill activities.

2.0 AIR MONITORING PROGRAM

2.1 INTRODUCTION

An air monitoring program will be performed for the following reasons:

A. To determine the presence of hazardous atmospheres and ensure that workers are wearing appropriate PPE. (PPE requirements are discussed in Section 8.0 of the Health and Safety Plan (HASP)). As discussed in Section 8.0, workers during the RA field activities will be wearing Level D PPE at the initiation of work.

B. To document the potential migration of dust and demonstrate whether adequate dust suppression methods are being employed.

This AMP identifies the procedure, instruments, and analytical methods to be used during the air monitoring program. Table AMP-1 summarizes the air monitoring equipment which may be used on this project and their function.

The air monitoring program will consist of real-time air monitoring and personal air monitoring for lead will be conducted in active work areas during the following RA field activities. The planned activities include soil sampling, excavation, stockpiling, soil treatment, transportation and backfilling. Air monitors will be placed upwind and downwind of active work areas, and for work areas on residential yards, at the closest commonly used point of ingress/grass.

The Health and Safety Officer (HSO) shall be responsible for all aspects of the air monitoring program including sample collection and informing the Project Manager (PM) of results. On-site calibrations of instruments will be performed as necessary and appropriate by the HSO in accordance with the instructions of the equipment manufacturer.

Lead has been identified as the main inorganic contaminant of concern during intrusive RA activities at the Site. The following sections discuss the air monitoring program to be conducted during the RA field activities.

2.2 REAL-TIME PARTICULATE MONITORING

Periodic, real-time particulate (dust) monitoring will be conducted utilizing a real-time aerosol monitor (RAM) which provides a reading of total dust in mg/m^3. The HSO will take periodic readings during the RA field activities to document dust emissions. These measurements will dictate whether an upgrade in PPE is required or if additional dust control is necessary.

The allowable dust levels on-site can be calculated for the compounds of concern using the following equation:

{Total Allowable Particulate of Concern Concentration (mg/m^3) = (estimated lead concentration) x (total particulate)}

This equation can be solved for the total allowable particulate as described below.

Lead has a TLV of 0.05 milligrams per cubic meter (mg/m^3). A safety factor of two provides an action level for lead of 0.025 mg/m^3. This is considered the total allowable particulate of concern concentration. Based on a 95 % confidence interval of the mean site soil lead concentration above 400ppm, a reasonable high site soil lead concentration is determined to be 5,000 mg/kg which is equivalent to 0.5% lead. The amount of airborne dust (total particulate) required to reach 0.025 mg/m^3 of lead is based a high site soil lead concentration of 5,000 mg/kg is as follows:

{Total Allowable Particulate Dust Concentration = 0.025 mg/m^3 x {1 mg/kg} / {0.005 mg/kg} = 5.0 mg/m^3}

The above calculation allows an accurate interpretation of the dust monitor data, relative to the chemical concentrations of concern at the Site. Personal protection levels will be increased in the event of total particulate levels measured above the specified action levels presented in Table AMP-2.

2.3 PERSONAL AIR MONITORING DURING SITE ACTIVITIES

The HSO will perform time-weighted average (TWA) air monitoring for lead exposure during the initiation of intrusive RA field activities. NIOSH Method number 7300 or equivalent will be used to collect, prepare, and analyze the samples to be collected for TWA considerations. One person for each job classification (i.e., backhoe operator, laborer) will be monitored in accordance with the Lead Construction Standard, 29 CRF 1926.62.

Sampling pumps will be calibrated before use to the appropriate flow rate. Pumps will be recalibrated after use to ensure that a constant flow rate is maintained during sampling. Calibration and maintenance of all sampling equipment will be performed by the HSO.

Air sampling will be performed for a minimum of seven hours during any eight hour work shift. Sampling results will be calculated as an eight hour time-weighted average and compared to the TLV for lead of 0.050 mg/m^3. The results of the air monitoring will be presented to the Project Manager and submitted to the QA Official. Results, as interpreted by the HSO and PM will dictate whether continued monitoring is necessary.

TABLES

Table AMP-1
Air Monitoring Equipment

INSTRUMENT	HAZARD MONITORED	APPLICATION	DETECTION METHOD	GENERAL CARE AND MAINTENANCE	OPERATING DURATION
Dust Monitor (Mini-Ram™)	Dust, aerosols, fumes, mist	Measures total or respirable particulate matter in air	Provides real time measurements of total or respirable particulate in a known volume of air	Recharge or replace battery	Battery life - 12 hrs. per charge
Personnel Air Monitor	Lead	Provides time-weighted averages (TWA) of concentration in milligrams per cubic meter	Laboratory analysis	Recharge battery, calibrate immediately before and after use	8 to 10 hours

Table AMP-2
Air Monitoring Methods, Action Levels and Protective Measures

Hazard	Monitoring Method	Action Level	Monitoring Schedule	Protective Measures (See Section 8.0)
Particulate Matter	Particulate monitor	Initially 2.5 mg/m^3 until the personal air monitoring data has been received, correlated to risk levels and discussed with EPA. Up to 5.0 mg/m^3 (respirable fraction) above background in the breathing zone after receipt of initial personal air monitoring results (if appropriate).	At the initiation of each task/operation and periodically (every 60 minutes) during invasive field activities and every 60 minutes near the property line (see Note 1)	Level D
		5.0-10.0 mg/m^3 (respirable fraction)	Periodically (every 60 minutes) during invasive field activities and every 60 minutes near the property line	Level C
		>10.0 mg/m^3 (respirable fraction)	Periodically (every 60 minutes) during invasive field activities and every 60 minutes near the property line	Level B
Lead	Personal Air Monitoring Laboratory Analysis Method #7300	0-0.025 mg/m^3	During first 3 days of operations and monthly thereafter	(Level D)
		0.025-1.25 mg/m^3	Continuously during intrusive operations as identified in HASP	Implement full face respirator use (Level C)
		>1.25 mg/m^3	Continuously during intrusive operations as identified in HASP	Implement powered air purifying respirator use (Level B)

Note 1

1. Monitoring frequency may be modified (increased/decreased) based on field conditions, SSO's observations and professional judgement (i.e., more monitoring on windy days - less monitoring on rainy days). All changes in monitoring frequency must be approved by the Project Manager.

ATTACHMENT 4 TO HASP

SITE CONTINGENCY PLAN

ATTACHMENT 4 TO HASP

SITE CONTINGENCY PLAN FOR

COLLINSVILLE, ILLINOIS PROPERTIES

Prepared By:

ADVANCED GEOSERVICES CORP.
West Chester, Pennsylvania

2003-1055-01
May 18, 2004

TABLE OF CONTENTS

1.0 INTRODUCTION

This Site Contingency Plan (SCP) was prepared by Advanced GeoServices Corp. (AGC) on behalf of the Respondents (NL Industries, Inc.) for the St. Louis Smelting and Refining Site (the "Site") in Collinsville, Madison County, Illinois to describe procedures during an emergency situation at the Site. This Plan is Attachment 4 of the Health and Safety Plan.

2.0 CONTINGENCY PLANNING

In the event of an emergency situation, the following order of notification will take place:

1. Person(s) witnessing an emergency will contact either the Project Manager or the Health and Safety Officer (HSO).

2. The Project Manager or HSO will immediately contact emergency assistance organizations (if necessary) and inform the site QA Official.

3. The QA Official will contact the EPA Case Manager and other local and regulatory agencies as required.

Emergency phone numbers are listed in Table HASP-1. This list will be kept current during the Remedial Action (RA) activities and will be clearly posted at the Site.

2.1 PRE-EMERGENCY PLANNING

Emergency evacuation routes will be designated upon arrival at the Site. During site orientation, all workers will be trained regarding the provisions of the emergency response plan, communication systems, and evacuation routes.

2.2 PERSONNEL ROLES AND LINES OF AUTHORITY

The HSO has primary responsibility for responding to and correcting emergency situations. This includes taking appropriate measures to ensure the safety of site personnel and the public, such as evacuation of site personnel and adjacent residents. The HSO shall also provide that corrective measures have been completed.

2.3 EMERGENCY RECOGNITION

Personnel should be familiar with techniques of hazard recognition from pre-assignment training and site-specific briefings.

2.4 EMERGENCY WARNING SIGNAL

The emergency signal shall be a continuous 30 second horn blast from a hand held air horn or a vehicle horn. Following the emergency signal, all personnel shall assemble in the support zone for an accounting and further direction by the HSO or the most senior field person present. If personnel are working in the exclusion zone, they shall exit by a safe and practical means. Decontamination shall be accomplished by the most practical means available.

2.5 EMERGENCY ESCAPE ROUTES

Site layout maps shall be available at the exclusion zone. Prior to commencement of work in a particular area, site personnel will be briefed on the escape route(s) for that area by the HSO. Figure HASP-2 shows the ingress and egress off-site and Figure HASP-3 shows the emergency route to the local hospital.

2.6 EMERGENCY CONTACTS

In the event of an emergency, the appropriate contacts from the list in Table HASP-1 will be made. This list of emergency phone numbers will be available at the Site.

2.7 EMERGENCY EQUIPMENT

The following equipment shall be available on-site during RA activities for use in the event of an emergency:

1. First Aid Kits

2. Fire Extinguishers
3. Telephone
4. Horn

2.8 MEDICAL EMERGENCIES

Any person who becomes ill or injured in the exclusion zone must be decontaminated to the maximum extent possible. If the injury is minor, full decontamination should be completed and first aid administered prior to transport. If the patient's condition is serious, at least partial decontamination should be completed. First aid should be administered while awaiting emergency medical services.

Any person being transported to a clinic or hospital for treatment should take with them information on the COCs they may have potentially been exposed to at the Site. This information is included in Table HASP-2. A map to the Anderson Hospital can be found in Figure HASP-3.
Directions to Hospital:

1. Exit the Site from Pine Lake Drive and turn right (southwest) onto Pine Lake Road. Travel approximately 0.5 miles on Pine Lake Road to Vandalia Street/IL-159.

2. Turn right onto Vandalia Street/IL-159 and travel approximately 2.2 miles.

3. IL-159 becomes IL-159/S Center City. Travel approximately 1.3 miles.

4. Turn right onto IL-162 and travel approximately 0.5 miles. The hospital address is 6800 State Route 162, and the telephone number is 618-228-5711.

3.0 EMERGENCY SITUATIONS

Emergency situations on-site can take the form of fire, explosions, or spills of hazardous liquids. The procedures below dictate what should be performed in the event of an emergency situation.

3.1 FIRE OR EXPLOSION

In the event of a fire or explosion, the local fire department should be contacted immediately. Upon their arrival, the designated personnel will advise the fire commander of the location, nature, and identification of the hazardous materials on-site.

If it is safe to do so, site personnel may:

- Use fire fighting equipment available on-site to control or extinguish the fire; and
- Remove or isolate flammable or other hazardous materials which may contribute to the fire.

3.2 SPILL CONTROL

Containers that have spilled shall be inspected and their integrity assured prior to being moved. If the integrity of the container is in question, it shall be over packed or the contents transferred. Operations shall be organized so as to minimize movement. Where spills, leaks, or ruptures may potentially occur, a supply of sorbents shall be stationed in the immediate area.

In the event of a spill or leak, site personnel will:

- Inform their supervisor and the HSO immediately;
- Locate the source of the spillage and stop the flow if it can be done safely; and
- Begin containment and recovery of the spilled materials with sorbent (vermiculite, etc.).

4.0 INCIDENT REPORTING

All accidents regardless of severity shall be reported immediately to the HSO and an incident report must be completed. This report shall be immediately forwarded to the Project Manager and QA Official for investigation and follow up. The HSO is responsible for ensuring corrective action(s) are taken to reduce the potential for recurrence.

ATTACHMENT 5 TO HASP

MEDICAL MONITORING

ATTACHMENT 5

Medical Monitoring

The Occupational Safety and Health Administration (OSHA) has established requirements for a medical surveillance program designed to monitor and reduce health risks for employees potentially exposed to hazardous materials (29 CFR 1910.120). This program has been designed to provide baseline medical data for each employee involved in hazardous waste operations including field activities, and to determine his/her ability to wear respiratory protection and be medically certified before he/she performs designated duties. Where medical requirements of 20 CFR 1910.120 overlap those of 29 CFR 1910.134, the more stringent of the two will be enforced.

The medical examination must be administered on a pre-employment and annual basis and as warranted by symptoms of exposure or specialized activities. These examinations shall be provided by employers without cost or loss of pay to the employee.

The medical examination shall include the following:

1. Medical History and Physical, including:

    - Medical questionnaire;
    - Completion of medical history with occupational risk factor analysis;
    - Examination by physician;
    - Evaluation of test results; and
    - Brief report sent to employer covering specific requested areas as well as pertinent positive findings; report sent to family physician and employee by request.

2. Pulmonary Function Testing;

3. Electrocardiogram (baseline, and at the discretion of examining physician);

4. Chest X-Ray (baseline, and at the discretion of examining physician);

5. Lab Tests, including:

- Urinalysis;
- Blood Chemistry Profile;
- Complete blood count with differential;

6. Vision Screen; and

7. Audiogram.

The examining physician is required to make a report to the employer of any medical condition which would place such employee at increased risk of wearing a respirator or other personal protective equipment. Each employer engaged in site work shall assume the responsibility of maintaining site personnel medical records as regulated by 29 CFR 1910.120, where applicable. Exemption from the medical surveillance program may be allowed by the HSO in conjunction with the Project Manager. These exemptions will be based on their interpretation of the requirements of 1910.120 relative to each individual exemption request.

Basically, an employee is required by federal regulation to have medical monitoring if the employee is or may be exposed to hazardous substances or health hazards at or above the permissible exposure limits for these substances, without regard to the use of respirators, for 30 days or more a year.

All employers contracted to work at the Site designated by this plan will be responsible to ensure their employees have received the proper medical tests as regulated by 29 CFR 1910.120 and shall provide the QA Official with certification of same.

ATTACHMENT 6 TO HASP

SPECIAL HAZARDS/CONSIDERATIONS EXCAVATION, TRENCHING, SHORING

ATTACHMENT 6

Special Hazards/considerations

Excavation, Trenching, Shoring

Excavation and trenching activities may occur at the Site during the RA activities. The following minimum procedures shall be followed when excavation and trenching activities are performed.

- The main concerns of trenching and excavation are ground control and fall prevention. Before an excavation is made, a thorough effort should be made to determine whether underground obstructions (such as sewer, telephone, fuel, water, or electrical lines) or above ground hazards may be encountered. Utility lines should be properly supported during excavation. The appropriate utility personnel should be contacted to inform them of the proposed site excavation work and to receive any additional advice based on their experience. Natural hazards such as boulders and trees should be removed or controlled before excavation begins if they might create a hazard to workers.

- Very specific guidelines exist to protect employees from moving ground during excavation. They are based on ground type and excavation depth. The walls and faces of all excavations to which employees are exposed should be guarded by a shoring system, a sloping of the ground, or another equivalent means. All slopes should be excavated to a degree which accommodates the ground's unique ability to slide. Soil types, listed below from most likely to least likely to slide, include:

    - well-rounded loose sand,
    - compacted sharp sand,
    - average soils,
    - compact angular gravel, and
    - solid rock, shale, or cemented sand and gravels.

Not all excavations need to be shored or sloped. The purpose of these precautions is to prevent crushing injury or suffocation. Banks more than five feet high shall be shored with materials in good condition or laid back to a stable slope based on ground type. Trenches less than five feet deep should also be protected if it appears that an injury may be caused by hazardous ground movement. Walkways, sidewalks, and runways should be free of excavated materials to prevent falls; planks used for raised walkways should be securely fastened at each end.

It is necessary to consider unexpected events or past ground work which might affect the security of the excavation site.

Additional precautions should be taken to prevent slides or cave-ins when trenches or excavations are made near backfilled excavations or where excavations are subject to external vibrations such as railway or highway traffic or machinery. Rain storms may seriously compromise the stability of excavation surfaces; a competent person should ensure that no weather-related decrease in safety has occurred.

Diversion ditches, dikes, or other suitable means should be used to prevent surface water from entering an excavation and to provide adequate drainage of the area adjacent to the excavation. Water should not be allowed to accumulate in an excavation. If it is necessary to place or operate power shovels, derricks, trucks, materials, or other heavy objects on a level above and near an excavation, the side of the excavation should be braced as necessary to resist the extra pressure from such loads. When mobile equipment is used next to excavations, substantial stop logs or barricades shall be installed. If possible, the grade should be away from the excavation.

The federal regulations on excavations and trenches are very specific. Refer to 29 CFR 1926.650-652 (Occupational Safety and Health Standards-Excavations; Final Rule) for complete details on excavation and trenching safety requirements.

APPENDIX D

SITE SECURITY PLAN

SITE SECURITY PLAN FOR

COLLINSVILLE, ILLINOIS PROPERTIES

Prepared By:

ADVANCED GEOSERVICES CORP.
West Chester, Pennsylvania

2003-1055-01
May 18, 2004

TABLE OF CONTENTS

PAGE NO.

1.0 INTRODUCTION

This Site Security Plan (the SSP) was prepared by Advanced Geoservices Corp. (AGC) on behalf of the Respondents (NL Industries, Inc.) for the St. Louis Smelting and Refining Site (the "Site") in Collinsville, Madison County, Illinois. This plan is Appendix D of the Removal Action Work Plan.

The purpose of the SSP is to provide the reader with a description of the proposed methods to be employed to delineate specific work areas during implementation of remedial action (RA) activities at the Site.

2.0 SITE ACCESS AND SITE CONTROL

2.1 SITE ACCESS

The specific RA field activity work areas at the Site will be divided into temporary work zones as a means to control access and decontamination efforts. The work zones include the following:

- **Support Zone:** This is the clean area and may be used for storage for excess non-contaminated equipment.

- **Contamination Reduction Zone (CRZ):** This is where the decontamination process will take place. This is the location of the decontamination pad and containers of contaminated personal protective equipment (PPE).

- **Exclusion Zone:** This is the potentially contaminated area.

Access to the RA field activities work zones will be limited to authorized personnel wearing the appropriate PPE. The exclusion zone may be cordoned off, if necessary, by colored tape or fencing, which will designate the exclusion zone boundary, as necessary. The zones will also be monitored by the Health and Safety Officer (HSO) or their designee to prevent personnel from unknowingly entering the exclusion zone without proper protection.

2.2 SITE CONTROL

Certain procedures will be followed to maintain RA field activity work area control and limit access so that those persons who may be unaware of the work area condition are not exposed to inherent hazards.

The HSO will be responsible for designating the locations of the work zones, and in conjunction with the Project Manager, making sure all employees working on-site are aware of these zones. The locations of work zones will change throughout the RA activities. The HSO will review the locations of work zones at the daily safety meetings.

When applicable, potentially contaminated media, such as soil and sediments, will be placed and covered in designated areas on-site to prevent unauthorized tampering.

APPENDIX E

FUGITIVE DUST CONTROL PLAN

FUGITIVE DUST CONTROL PLAN FOR

COLLINSVILLE, ILLINOIS PROPERTIES

Prepared By:

ADVANCED GEOSERVICES CORP.
West Chester, Pennsylvania

2003-1055-01
May 18, 2004

TABLE OF CONTENTS

PAGE NO.

1.0 INTRODUCTION

This Fugitive Dust Control Plan (the FDCP) was prepared by Advanced GeoServices Corp. (AGC) on behalf of the Respondents (NL Industries, Inc.) for the St. Louis Smelting and Refining Site in Collinsville, Madison County, Illinois. This plan is Appendix E of the Removal Action Work Plan. The purpose of this FDCP is to provide the reader with a description of the proposed activities to be performed to minimize fugitive dust generation during the implementation of removal action (RA) activities.

2.0 REMEDIAL ACTIONS REQUIRING CONTROLS

Soil excavation, stockpiling and transportation activities will be conducted and are expected to require dust control measures. These RA elements are discussed briefly below. Section 3.0 of this FDCP addresses the dust control procedures to be implemented for each of these elements.

2.1 SOIL EXCAVATION

Soil removal (excavation) will be conducted on several residential properties at the Site. Excavation will be performed using conventional construction equipment such as backhoes, skid-steers (aka bobcats), front-end loaders, and dump trucks. These operations have the potential to generate dust during soil handling. Dust control measures for these operations are discussed in Section 3.0.

2.2 SOIL TREATMENT

Following excavation, some of the soils may require treatment prior to disposal. Such soil will be transported to the staging area for treatment, as follows:

- Excavated soil placed in the staging area for treatment will be stabilized to meet the requirements of the selected off-site disposal facility.

- The stabilization process involves the addition of reagents that, when mixed with the waste, combine chemically with the waste constituents to decrease mobility of the original waste constituents. The stabilization process would consist of mixing of the soil with a stabilization agent to achieve the desired reduction in leaching potential. During stabilization, the procedures established for dust control would apply.

2.3 BACKFILL

As part of property restoration, structural soil fill and topsoil will be placed on the disturbed properties. These backfill operations will be performed with conventional construction equipment and have the potential to generate fugitive dust. Dust control measures for these operations are discussed in Section 3.0.

3.0 DUST CONTROL PROCEDURES

This section describes the dust control procedures to be implemented during the soil and restoration operations. Generally, the control procedures can be grouped into three categories as follows: 1) Air Monitoring, 2) Worker Training, 3) Dust Control Measures.

3.1 AIR MONITORING

Air monitoring, for the protection of site personnel and the community, will be performed at the Site during implementation of the RA. Specific action levels are provided in the Health and Safety Plan (HASP) (Appendix C). The purpose of emission and dust control, as presented herein, is to ensure that conditions at the Site during implementation of the RA do not result in unacceptable levels of dust emissions such that action levels are exceeded. This will be confirmed through visual observation of the presence/absence of dust, real-time air monitoring, and periodic air sampling (see Air Monitoring Plan, Attachment 1 of the HASP).

3.2 WORKER TRAINING

One of the primary methods for dust control is worker education and training. The following procedures will be implemented at the Site during remedy implementation in order to minimize dust:

- Train workers about the primary purpose of dust control: worker and community safety;
- Train workers and reinforce concepts at safety meetings regarding the necessity to perform their tasks in a manner that does not generate dust;
- Keep work areas neat, clean and dust-source free as a standard operating procedure;

- Maintain dust suppression operations in assigned work areas;

- Notify supervisors of dusty conditions whenever they are visually apparent and request dust suppression when needed.

3.3 DUST CONTROL MEASURES

The following measures will be used singularly or in combination to prevent conditions conducive to fugitive dust emissions or to suppress dust should it occur. These methods are presented in accordance with project functions or specific work areas.

3.3.1 Dust Control During Excavation

The largest potential source of dust and emissions during the Site remediation will be the excavation and handling of material during soil removal. The following procedures will be implemented to control the generation and migration of dust during the excavation and handling of materials:

- Apply water directly to the active excavation such that disturbed soils do not release fugitive dust. This includes applying water to the truck loading operations, as appropriate and pre-watering excavations that are near-surface and that may have the potential to release fugitive dust when excavation begins.

- Promptly apply water to excavation or loading operations upon any observance of dust.

- Control dust during operation of trucks by not allowing material to be dropped from heights above the top rail of the truck body.

- Regularly inspect all rear gate seals and locking mechanisms on material transport vehicles in order to prevent spillage and dust production.

- Broom sweep and/or wash the trucks prior to leaving the loading areas to prevent the deposition of material along the haul route.

- Clean up all spilled soil material within the loading area and work areas.

- Tarp all trucks used for both on-site and off-site transport of materials.

3.3.2 Dust Control on Haul Roads

The roads on the Site proposed for use in transporting material are existing residential paved roads. The following dust control measures will be implemented to control the generation of dust during material transport on-site:

- Tarp all trucks delivering and/or transporting material on-or off-site.

- Periodically apply water to paved roads that are being used for transport of excavated materials. Water will be applied using a water truck dedicated to the Site. Periodically broom sweep asphalt areas after the application of water to remove the buildup of dust/dirt.

- Promptly apply water to haul roads upon any observance of dust.

- Obey and enforce speed limits on haul roads to minimize fugitive dusts during transport.

- Clean up all material that is spilled on the roadway or other surfaces immediately and broom-sweep the area.

3.3.3 Dust Control During Stockpiling

If any excavation requires stockpiling of material, these stockpiles will be managed in the following manner:

- Cover stockpiles with tarps, polyethylene sheeting, or similar material at the end of each work day. Cover and ballast the pile at the end of the excavation such that the cover is stable for an extended period of time.

- Periodically inspect the stockpile covers to confirm that the covers are intact and are functioning as intended.

- Apply water to the piles prior to covering, as necessary.

3.3.4 Dust Control During Earthworks Operations

Several earthworks and restoration operations will be conducted at the Site during the RA that have the potential to generate fugitive dusts. These operations include backfilling of disturbed areas, grading, and equipment decontamination. All dust control operations will be performed in a similar manner as those specifically discussed above. Specifically, any operation which has the potential to generate visible dust or dusty conditions (Air Monitoring Plan, Health and Safety Plan) will be subject to the same dust-suppressing operations as discussed above.

3.4 DUST CONTROL CORRECTIVE OPERATIONS

In the event that the control measures described above are not effectively minimizing dust to the levels identified in the HASP, the Contractor will implement corrective measures that will include, but not be limited to, the following:

- Cease operations or decrease the pace of operations in the area that is the source of the emissions until the problem is corrected.
- Apply additional water to near-surface soil areas to be excavated.
- Cover, enclose or otherwise isolate the material that is creating the dust until an alternate plan can be developed.
- Modify operating procedures and methods to eliminate the problematic conditions.
- Continue monitoring the dust conditions and resume normal operations once acceptable conditions are achieved.

APPENDIX F

STORMWATER RUNOFF CONTROL PLAN

STORMWATER RUNOFF CONTROL PLAN FOR

COLLINSVILLE, ILLINOIS PROPERTIES

Prepared by:

ADVANCED GEOSERVICES CORP.
West Chester, Pennsylvania

Project No. 2003-1055
May 18, 2004

TABLE OF CONTENTS

LIST OF FIGURES

FIGURES

1.0 INTRODUCTION

This Stormwater Runoff Control Plan (SRCP) was prepared by Advanced GeoServices Corp. (AGC) on behalf of the Respondents (NL Industries, Inc.) for the St. Louis Smelting Site (the "Site") in Collinsville, Madison County, Illinois. This Plan is Appendix F of the Removal Action Work Plan. The purpose of the SRCP is to provide the reader with a description of the proposed Best Management Practices (BMPs) to be implemented during the removal action (RA) activities at the Site.

2.0 SEQUENCING OF BEST MANAGEMENT PRACTICES (BMPs)

2.1 FILTER FABRIC AND STRAW BALES

Prior to clearing, grubbing or soil removal activities, filter fabric fence shall be installed along the down slope perimeter of the properties to be disturbed. Figure SRCP-1 shows a construction detail of a filter fabric fence. Figure SRCP-2 shows the installation of straw bales. Straw bales will be used in conjunction with filter fabric fence to help strengthen against high velocity flows if needed or stand alone in areas where temporary protection is warranted. Straw bales are to be utilized at the approval of the QA Official. In addition to the work zone, filter fabric fence will be placed along the perimeter of the soil staging area. Also, filter fabric fence will be installed between any excavated soils and clean fill stockpiles. When remedial activities are implemented near a water body, a double row of silt fence will be installed. There shall be a minimum of three feet between the rows to allow effective and independent operation of the sediment control.

2.2 INLET PROTECTION

Inlet protection devices will be installed on all stormwater inlets downslope of any excavation and backfill activities as well as the soil staging area. Figure SRCP-3 depicts a typical inlet protection device. During the excavation, stockpiling and restoration of the site properties, the previously mentioned BMPs will be maintained on a regular basis. No additional BMPs are proposed during the soil disturbance activities of the work.

2.3 ROCK CONSTRUCTION ENTRANCE/DECONTAMINATION PAD

The Contractor shall construct a rock construction entrance/decontamination Pad at the ingress/egress area of the construction staging area. The Contractor shall prevent any soil/sediment from releasing to the surface street. All vehicles shall be decontaminated prior to exiting the staging

area. Dry decontamination methods shall be employed; however, the QA official has the authority to direct the Contractor to use wet methods (power spray) as necessary. Figure SRCP-4 provides a detail of a rock construction entrance/decontamination pad.

2.4 SEEDING

Following the placement of fill on a property, the area will be seeded to produce a continuous vegetative cover that will effectively reduce erosion rates to pre-developed conditions. AGC contacted Madison County, Illinois to determine an appropriate seed mixture for the properties to be remediated. The County's Master Gardener, in turn, referred AGC to a local seed distributor which recommended the mixture below which shall be planted between April and October. The Contractor may elect to use another mixture that will produce turf throughout the aforementioned months of the year. This mixture must be approved by the QA Official prior to use.

Variety	Germination % / Origin
18.98% Crossfire II Tall Fescue	90 / ORE
18.88% Mini-Mustang Tall Fescue	90 / ORE
18.88% Shortstop II Tall Fescue	90 / ORE
18.80% Dynasty Tall Fescue	90 / ORE
18.79% Mustang III Tall Fescue	90 / ORE
4.99% Bronco KY Bluegrass	85 / ORE

Following seeding activities, mulch shall be spread over seeded areas at a rate of 3 tons/acre.

3.0 INSPECTION AND MAINTENANCE PROGRAM

An inspection and maintenance program will be implemented during the earth disturbance activity. Throughout the duration of earth disturbance activities, BMPs shall be inspected weekly and after each significant rainfall event. The following inspections shall be performed:

- Inspect the entire length of silt fence and straw bales. Any portions of the silt fence or straw bales that are damaged, or are not functioning as intended, shall be replaced. Sediments shall be removed from behind the silt fence once the depth of accumulated sediments is greater than 1/3 of the height of the fence.

- Inspect all inlet protection weekly or after each rainfall event. If accumulated sediment is 1/3 of the depth of the fabric, remove sediment and replace fabric.

- Inspect the rock construction entrance/decontamination pad weekly and remove sediment or place additional stone.

FIGURES

NOTES:

1. THE HEIGHT OF A SILT FENCE SHALL NOT EXCEED 36 INCHES (90 cm). HIGHER FENCES MAY IMPOUND VOLUMES OF WATER SUFFICIENT TO CAUSE FAILURE OF THE STRUCTURE.

2. THE FILTER FABRIC SHALL BE PURCHASED IN A CONTINUOUS ROLL CUT TO THE LENGTH OF THE BARRIER TO AVOID THE USE OF JOINTS. WHEN JOINTS ARE NECESSARY, FILTER CLOTH SHALL BE SPLICED AS DESCRIBED IN ITEM No. 6 BELOW.

3. POSTS SHALL BE SPACED A MAXIMUM OF 10 FEET (3 m) APART AT THE BARRIER LOCATION AND DRIVEN SECURELY INTO THE GROUND A MINIMUM OF 12 INCHES (30 cm). WHEN EXTRA STRENGTH FABRIC IS USED WITHOUT THE WIRE SUPPORT FENCE, POST SPACING SHALL NOT EXCEED 6 FEET (1.8 m).

4. A TRENCH SHALL BE EXCAVATED APPROXIMATELY 4 INCHES (10 cm) DEEP AND 4 INCHES (10 cm) WIDE ALONG THE LINE OF POSTS AND UPSLOPE FROM THE BARRIER.

5. THE STANDARD STRENGTH FILTER FABRIC SHALL BE STAPLED OR WIRED TO THE FENCE, AND 8 INCHES (20 cm) OF THE FABRIC SHALL BE EXTENDED INTO THE TRENCH. THE FABRIC SHALL NOT EXTEND MORE THAN 36 INCHES (90 cm) ABOVE THE ORIGINAL GROUND SURFACE.

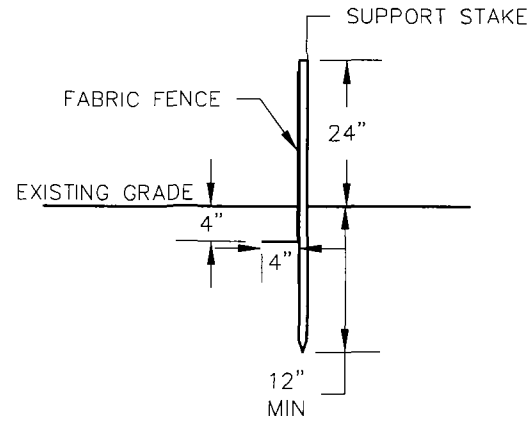
6. WHEN ATTACHING TWO SILT FENCES TOGETHER, PLACE THE END POST OF THE SECOND FENCE INSIDE THE END POST OF THE FIRST FENCE. ROTATE BOTH POSTS AT LEAST 180 DEGREES ON A CLOCKWISE DIRECTION TO CREATE A TIGHT SEAL WITH THE FILTER FABRIC. DRIVE BOTH POSTS INTO THE GROUND AND BURY THE FLAP. (SEE FIGURE)

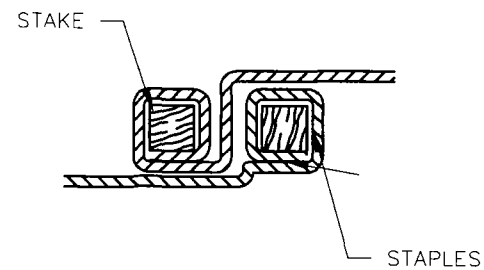
7. THE TRENCH SHALL BE BACKFILLED AND THE SOIL COMPACTED OVER THE FILTER FABRIC.

8. THE MOST EFFECTIVE APPLICATION CONSISTS OF A DOUBLE ROW OF SILT FENCES SPACED A MINIMUM OF 3 FEET APART. THE 3 FOOT SEPARATION IS SO THAT IF THE FIRST ROW COLLAPSES IT WILL NOT FALL ON THE SECOND ROW. WIRE OR SYNTHETIC MESH MAY BE USED TO REINFORCE THE FIRST ROW.

9. WHEN USED TO CONTROL SEDIMENTS FROM A STEEP SLOPE, SILT FENCES SHOULD BE PLACED AWAY FROM THE TOE OF THE SLOPE FOR INCREASED HOLDING CAPACITY.

10. SILT FENCES SHALL BE REMOVED WHEN THEY HAVE SERVED THEIR USEFUL PURPOSE, BUT NOT BEFORE THE UPSLOPE AREA HAS BEEN PERMANENTLY STABILIZED.





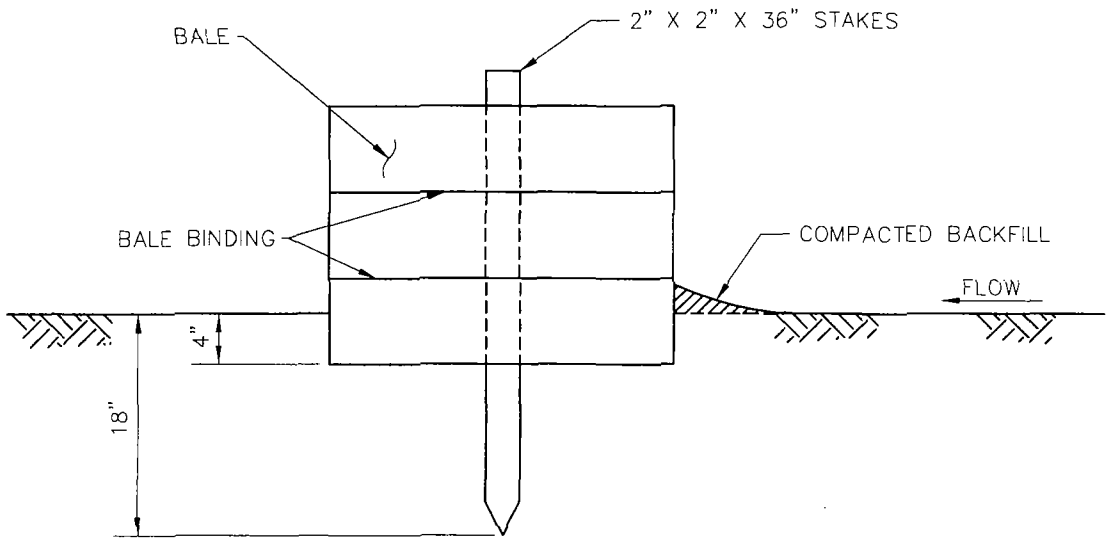
ST. LOUIS SMELTING AND REFINING SITE

COLLINSVILLE, ILLINOIS

Scale: N.T.S.	FILTER FABRIC FENCE DETAIL
Originated By: K.O.	
Drawn By: P.S.G.	
Checked By: K.O.	
Project Mgr: C.T.R.	
Dwg No. 2003-1055-01-13	
MAY 18 2004	Project No. 2003-1055-01 — FIGURE: SRCP-1

Advanced GeoServices Corp.
1055 Andrew Drive, Suite A
West Chester, Pennsylvania 19380
(610) 840-9100
FAX: (610) 840-9199

J:\Collinsville Smelter\drawings\2003-1055-01\2003-1055-01-13



NOTES:

1. STRAW BALE BARRIERS SHOULD NOT BE USED FOR MORE THAN 3 MONTHS.
2. STRAW BALE BARRIERS SHALL BE PLACED AT EXISTING LEVEL GRADE. BOTH ENDS OF THE BARRIER SHALL BE EXTENDED AT LEAST 8 FEET UP SLOPE AT 45 DEGREES TO THE MAIN BARRIER ALIGNMENT.
3. SEDIMENT SHALL BE REMOVED WHEN ACCUMULATIONS REACH 1/3 THE ABOVE GROUND HEIGHT OF THE BARRIER.
4. THE BARRIER SHALL BE ENTRENCHED AND BACKFILLED. A TRENCH SHALL BE EXCAVATED THE WIDTH OF THE BALE AND THE LENGTH OF THE PROPOSED BARRIER TO A MINIMUM OF 4 INCHES.
5. EACH BALE SHALL BE ANCHORED BY AT LEAST TWO 2"x2" MINIMUM WOODEN STAKES OR TWO #5 MINIMUM REBARS AT LEAST 3 FEET DRIVEN THROUGH THE BALE.
6. BALES SHALL BE PLACED IN A SINGLE ROW, LENGTHWISE ON THE CONTOUR WITH ENDS OF ADJACENT BALES TIGHTLY ABUTTING EACH OTHER.
7. THE GAPS BETWEEN BALES SHALL BE CHINKED (FILLED BY WEDGING) WITH STRAW TO PREVENT WATER FROM ESCAPING BETWEEN BALES.

ST. LOUIS SMELTING AND REFINING SITE

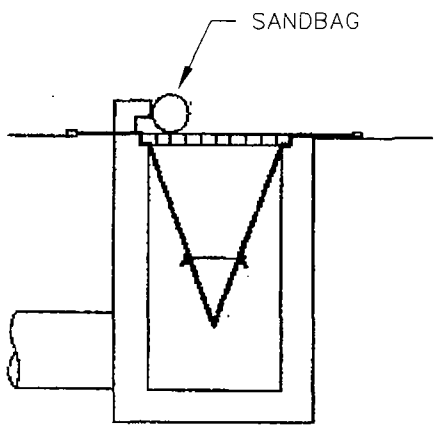
COLLINSVILLE, ILLINOIS

Scale: N.T.S.	STRAW BALE BARRIER DETAIL
Originated By: K.O.	
Drawn By: P.S.G.	
Checked By: K.O.	
Project Mgr: C.T.R.	
Dwg No. 2003-1055-01-13	
MAY 18 2004	Project No. 2003-1055-01

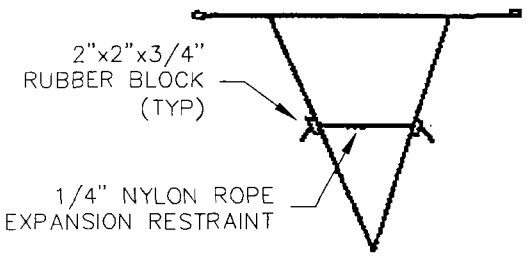
Advanced GeoServices Corp.
1055 Andrew Drive, Suite A
West Chester, Pennsylvania 19380
(610) 840-9100
FAX: (610) 840-9199

FIGURE: SRCP-2

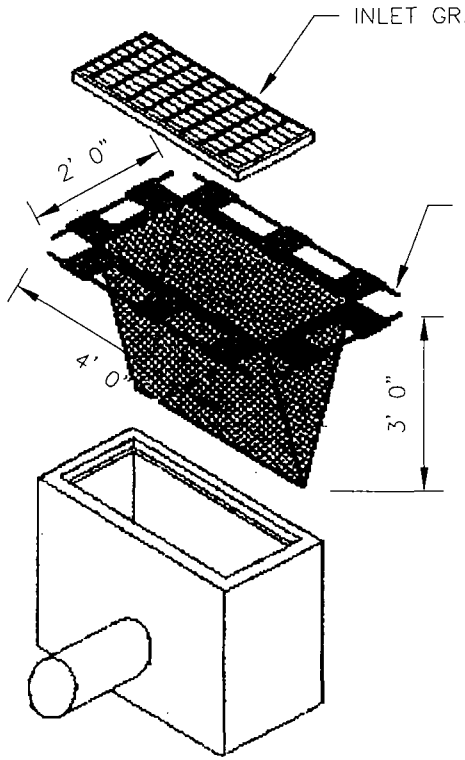
J:\Collinsville Smelter\drawings\2003-1055-01\2003-1055-01-13



INSTALLATION DETAIL



BAG DETAIL



ISOMETRIC VIEW

NOTES:

1. INLET PROTECTION IS NOT REQUIRED FOR INLET TRIBUTARY TO SEDIMENT BASIN OR TRAP.
2. DO NOT USE ON MAJOR PAVED ROADWAYS WHERE PONDING MAY CAUSE TRAFFIC HAZARDS.
3. SANDBAGS TO BE PLACED OVER INLET OPENING ADJACENT TO CURBS.

ST. LOUIS SMELTING AND REFINING SITE

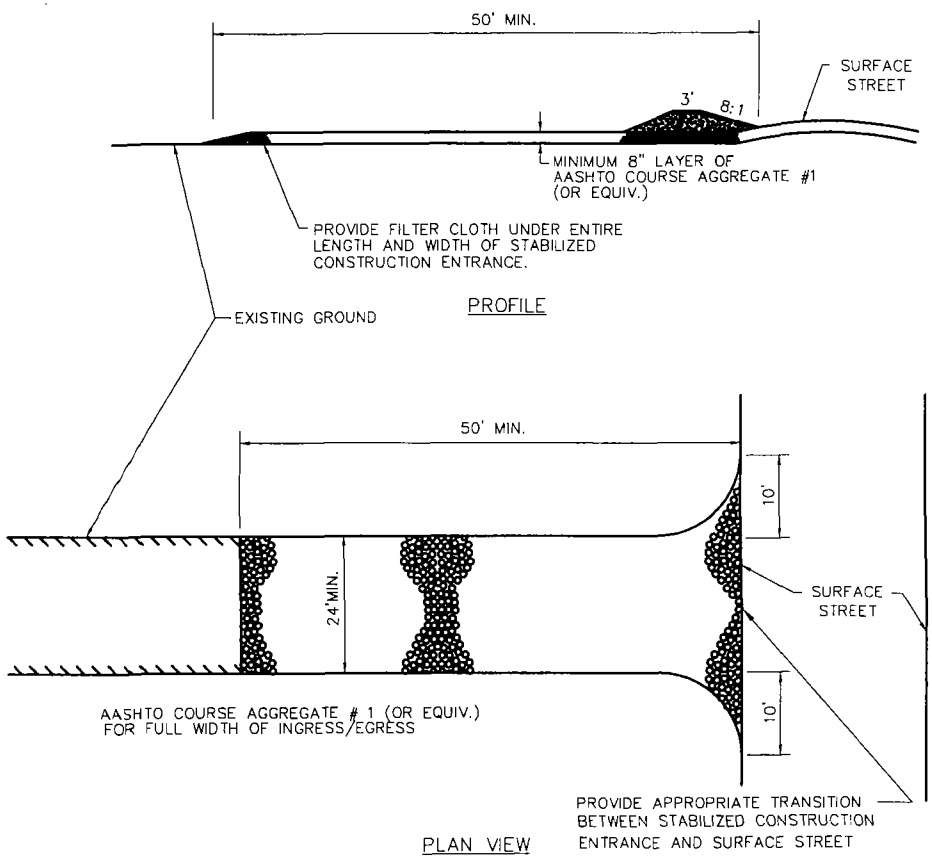
COLLINSVILLE, ILLINOIS

Scale: N.T.S.	INLET PROTECTION DETAIL
Originated By: K.O.	
Drawn By: P.S.G.	
Checked By: K.O.	
Project Mgr: C.T.R.	
Dwg No. 2003-1055-01-13	
MAY 18 2004	Project No. 2003-1055-01

Advanced GeoServices Corp.
1055 Andrew Drive, Suite A
West Chester, Pennsylvania 19380
(610) 840-9100
FAX: (610) 840-9199

FIGURE: SRCP-3

J:\Collinsville Smelter\drawings\2003-1055-01\2003-1055-01-13



NOTES:

1. STABILIZED CONSTRUCTION ENTRANCE / DECONTAMINATION PAD SHALL BE MAINTAINED IN A CONDITION WHICH WILL PREVENT TRACKING OR FLOWING OF SEDIMENT ONTO SURFACE STREET. MAINTENANCE MAY REQUIRE PERIODIC TOP DRESSING WITH ADDITIONAL STONE AS CONDITIONS DEMAND.

2. CONTRACTOR SHALL REMOVE ALL SOIL/SEDIMENT FROM VEHICLES PRIOR TO EXITING STAGING AREA. DRY METHODS (BROOM) MAY BE USED, HOWEVER, THE QA OFFICIAL MAY DIRECT THE CONTRACTOR TO USE A WET METHOD (POWER SPRAY), IF NECESSARY.

ST. LOUIS SMELTING AND REFINING SITE

COLLINSVILLE, ILLINOIS

Scale: N.T.S.	ROCK CONSTRUCTION ENTRANCE / DECONTAMINATION PAD DETAIL
Originated By: K.O.	
Drawn By: P.S.G.	
Checked By: K.O.	
Project Mgr: C.T.R.	
Dwg No. 2003-1055-01-13	
MAY 18 2004	Project No. 2003-1055-01

Advanced GeoServices Corp.
1055 Andrew Drive, Suite A
West Chester, Pennsylvania 19380
(610) 840-9100
FAX: (610) 840-9199

FIGURE: SRCP-4

J:\Collinsville Smelter\drawings\2003-1055-01\2003-1055-01-13

APPENDIX G

PUBLIC RELATIONS PLAN

PUBLIC RELATIONS PLAN FOR

COLLINSVILLE, ILLINOIS PROPERTIES

Prepared By:

ADVANCED GEOSERVICES CORP.
West Chester, Pennsylvania

2003-1055
May 18, 2004

TABLE OF CONTENTS

PAGE NO.

1.0 INTRODUCTION

This Public Relations Plan (PRP) was prepared by Advanced GeoServices Corp. (AGC) on behalf of the Respondent (NL Industries, Inc.) for the St. Louis Smelting and Refining Site (the "Site") in Collinsville, Madison County, Illinois. This Plan is Appendix G of the Removal Action Work Plan.

The PRP is intended to describe the mechanism for communicating with property owners and regulatory officials regarding Removal Action (RA) activities to be conducted at the Site.

2.0 FACILITY CONTACT

The following person may be contacted with questions or comments concerning the RA to be conducted at the St. Louis Smelting and Refining Site in Collinsville, Illinois.

Christopher Reitman
Advanced GeoServices Corp.
Tel: (610) 840-9100

In addition, the following representative from the United States Environmental Protection Agency (USEPA) may be contacted with questions or comments and Freedom of Information Act requests.

Kevin Turner

Tel: (618) 997-0115

In addition, the following representative from The Illinois Environmental Protection Agency (IEPA) may be contacted with questions or comments and Freedom of Information Act requests.

Gerald Willman

Tel: (217) 524-6365

3.0 PUBLIC RELATIONS PLAN

As part of the Site remediation program, the Respondent and Advanced GeoServices Corp. (AGC) intends to work with the USEPA to provide open and comprehensive communication with the community. AGC intends to participate in public meetings to keep the community informed and educated about various components of the remediation.

3.1 OBJECTIVES

The Community Relations Program will provide for open dialog among AGC, the Respondent, USEPA, the Collinsville community, and state and local officials to enhance understanding of the Remedial Action and provide a forum for comment from interested parties. In addition, regular updates will be provided on the status of the ongoing site remediation as the process moves forward.

3.2 COMMUNITY RELATIONS TECHNIQUES

The following activities will be conducted to follow through with the Community Relations Program. The extent to which these techniques are used will depend on community interest in the project.

3.2.1 Document Repository

AGC will retain a copy of all required reports and documentation of the St.Louis Smelting and Refining Site remediation project, which are completed and submitted to the USEPA, at a local public repository so interested parties can review the materials and make copies if desired. The public repository is expected to be at the following:

Collinsville Memorial Public Library
408 West Main Street
Collinsville

Madison County, Il 62234
(618)344-1112
Opening Hours: Monday-Thursday 9am-8pm
Friday and Saturday 9am-5pm
Sunday 1pm-5pm

Members of the public who have questions about the documents, or any other aspect of the St. Louis Smelter Site remediation project, should call the On-Scene Coordinator, Kevin Turner, at the United States Environmental Protection Agency Region 5 Office in Marion, Illinois, Telephone # 618-997-0115.

3.2.2 Establish Contact with Residents and Adjacent Neighbors

To ensure open communications with property owners of the Site, a letter and Access Agreement will be issued prior to the start of RA activities informing the property owners about the upcoming field activities.

3.2.3 Community Meetings

Prior to Site activities, a community meeting will be conducted at a location in proximity to the Site. It is anticipated that a general overview of the operations/activities will be explained followed by a question and answer session.

Questions and answers will be recorded during the meeting and transcribed and distributed to interested parties by AGC within two weeks following the meeting. The transcript will also include answers to those questions not answered during the public meeting.

The primary host of such public meetings will be coordinated with USEPA and IEPA. AGC expects that representatives of the IEPA and USEPA will also participate to clarify issues discussed by AGC as necessary and to answer questions from the public regarding the regulatory aspects of the project.

3.2.4 Pre-Excavation Meetings

Prior to the start of removal activities on a given property, The QA Official and a representative from the Contractor will meet with each property owner to describe the soil removal and restoration activities to be performed on the property, including a tentative schedule.

APPENDIX H

SCHEDULE OF WORK PLAN ACTIVITIES

ID	Task Name	Dgust	Septemb	October	Novembe	December	January	February	March
1	**WORK PLAN**								
2	*Submit Work Plan to USEPA*								
3	*USEPA Review*								
4	*Revise and Resubmit Work Plan*								
5	*USEPA Review and Approval*								
6	**COMMUNITY RELATIONS**								
7	*Community Information Meeting (TBD)*								
8	*Access Agreeements*								
9	**INVESTIGATION**								
10	*Lateral Composite Sampling*								
11	*Data Validation and Interpretation*								
12	**CONTRACTOR SELECTION**								
13	*Prepare Bid Package and Send*								
14	*Contractor Bid Review and Submittal*								
15	*Bid Package Review / Negotiate Contract*								
16	*Notice to Proceed*								
17	**REMEDIAL ACTIVITIES**	3							
18	*Mobilization/Site Preparation*	3							
19	*Remediation and Restoration of Initial Properties*								
20	*Winter Shutdown*	1							
21	*Remediation and Restoration ofSubsequent Propertie*	1							
22	**FINAL REPORT TO USEPA**								

Project: Collinsville
Date: Fri 6/18/04

Task

Split

oject Summary

JUN 18 2004